A handbook for medics
and medical teachers

Save Lives
Save Limbs

Life support for victims of mines, wars, and accidents

Hans Husum

Mads Gilbert
Torben Wisborg

Foreword by
Nobel peace prize laureate
Rae McGrath

Third World Network

Write to us

This book is just a start. Help us improve it. Please send us your views regarding in-field medical treatment, teaching methods, or drawings and photos that you feel should be included in this book. Let us know if you find parts of the book confusing, incorrect, or badly written.

We are in particular interested in suggestions from rural health workers with personal, hands-on experience in giving first aid to mine and war victims.

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Thank you!

List of abbreviations

km	kilometer, a unit of distance made up of one thousand meters.
m	meter. One hundred centimeters make up one meter.
cm	centimeter. Ten millimeters in one centimeter.
mm	millimeter. One thousand millimeters make up one meter.
L	liter, a measure of volume, made up of one thousand milliliters.
mL	milliliter, a measure of volume.
kg	kilogram, a measure of weight, with one thousand grams in one kilogram.
g	gram. One thousand milligrams are in one gram.
mg	milligram, a unit of weight.
Hg	mercury. "mm mercury" is a unit to measure pressure, e.g. blood pressure.
BP	blood pressure (systolic).
HR	heart rate: number of heartbeats each minute.
RR	respiratory rate (breathing rate): n eaths each minute.
IM	intramuscular.
IV	intravenous.
IU	international units (amount of penici
Ringer	any IV electrolyte infusion (lactated R or NaCl 0.9%)
°C	temperature in degrees Celcius.
e.g.	for example.
CPR	Cardio-pulmonary resuscitation (life support for lifeless p).
NGO	Non-Governmental Organization.

Also see glossary, p. 213

Save Lives
Save Limbs

Ahmed should have died

It was spring 1997: The mountains were green and the grasslands rich. Ahmed, a Kurdish herdsboy, was on his way home with the cattle. It had been a good day, but now Ahmed was hungry.

While thinking of his mother and warm, fresh bread, Ahmed stepped on a VS50 blast mine. The mine tore off his right leg at the knee, and fired small stones into his other leg and his belly. When the villagers found Ahmed 30 minutes later, he was unconscious but moaning. Under him the ground was soaked with blood.

The villagers managed to stop the bleeding from the limb wounds, and carried Ahmed two hours on horseback to find Ibrahim, the medic in Tawela village. By the time they got to Tawela, Ahmed was close to death. Ibrahim placed intravenous cannulas in the neck veins and gave him four liters of warm intravenous saline infusion – and ketamine to take away the pain.

It was seven hours after the injury when Ibrahim carried the herdsboy into Suleimaniah Teaching Hospital. Ahmed was still alive. They did surgery on Ahmed that same night. One meter of Ahmed's intestines was torn by mine fragments and had to be removed.

Three weeks later, Ahmed left the hospital on crutches. If somebody could make him an artificial limb, he could still be a herdsboy.

Ahmed would have died if it had not been for the medic Ibrahim and the village first helpers he had trained.

Read more about Ahmed on p. 18 and p. 36.

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Note:
Although **Save Lives, Save Limbs** encourages non-graduate health workers to give medical life support to victims of injury, this book cannot replace practical instruction by qualified experts. Neither the publisher nor the authors of this volume are responsible for damage done by unqualified implementation of the described procedures.

The photos of victims are manipulated for the persons not to be recognized. Their injuries are, nowever, not manipulated or altered.

In this book we use the masculine pronouns (he, his, his) for medics and victims, although the terms are to apply to both sexes.

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Foreword

I live in a rural area of the north-west of England where agriculture, especially livestock farming, is at the core of the fragile local economy. Close by are the borders of the Lake District National Park where the wild mountains and beautiful lakes draw tourists from all over the world. As I rode on my bike among grazing livestock on the hills a few days ago I tried to imagine that this land was struck by the same devastating epidemic which has swept across so many countries during the past two decades – the deadly landmine virus. I tried to visualise the limbless farmers, the productive land overgrown with weeds, the barbed wire draped with red warning signs and the schoolchildren learning to recognise landmines and cluster bomblets as part of the daily curriculum. I could see the tourist buses rusting and unused – who takes their holidays in minefields? And then the drift of families away from the country to the cities of the south, giving up the fight in the face of a disease for which there are no short-term cures. The vision is frightening but it is not frightening enough. It does not scare those of us who live in the *mine-free world* sufficiently that we make more than a nominal response to the human misery which landmines cause in other, less comfortable, societies.

We hear politicians in Europe, Scandinavia, Canada, Australia and, (perversely, since it still manufactures anti-personnel mines), the United States boasting of their respective contributions to the international mine clearance effort; as though this was some kind of popular competition rather than a human duty. The truth is that no country has contributed funds based on a realistic assessment of need and a large proportion of the funding allocated has been wasted on ill-judged and inappropriate initiatives often motivated more by the regional political goals of the donor nation than by any concern for mine-affected communities. It is little use conjuring fading visions of a crusading British princess and a Nobel Peace Prize-winning campaign when the deaths and maimings caused by landmines continue to rise and the international response has decreased in every year since 1995. There is a need for a new campaign – a vibrant caring field-based crusade centred on engineering reality and the real needs of the communities whose land is mined rather than inexpert assessments tailored to fit pre-determined budgets.

It takes a massive deployment of engineering skills to survey and mark minefields and many years of high-cost field operations to clear them from the land – an undertaking which, on a global scale, could be equated to the task of ridding the world of a contagious disease. The comparison must be taken further because the victims need treatment, usually in a post-conflict environment where living long enough to reach hospital is the defining survival factor. It is an uncomfortable fact that having the very best surgical facilities in a city-located hospital may be of little use to the great majority of those most likely to need its services because they live in rural areas and are unlikely to reach the hospital alive.

The solution lies in the empowerment of rural communities to become *first responders,* not just for the victims of landmines, but for road accidents, drownings, heart attacks and all the day-to-day medical emergencies. Communities who have these basic first aid and medical skills will experience a dramatic increase in casualties who survive to reach hospital – these are skills which can be easily transferred and sustained. The ability to respond locally also helps to rebuild self-belief and confidence in communities traumatised by war and its after-effects. This book is a vital resource for every organisation and individual who work with landmine-affected communities and should be required reading for all donors.

Rae McGrath
Langrigg
September 1999

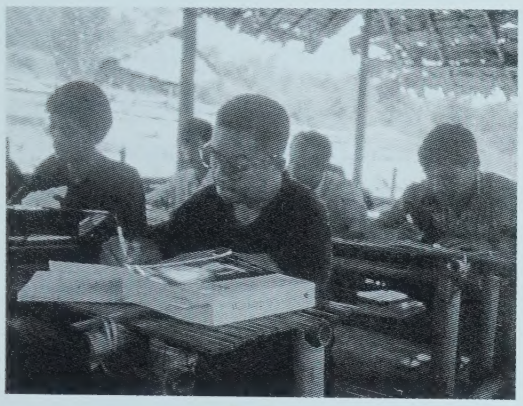
Contributors

Practical training with Dr. Reha at Jalalabad.

This book is the result of ten years of teamwork of a hundred local health workers inside the minefields and war zones in the South. In these ten years more than 5,000 injured were given life-saving first aid at the site of injury, in rain and snow, in tents and under bridges – at times under fire. The patients were carried day and night in hammocks, in river boats, and on donkeys to reach faraway hospitals. Injuries, treatment and results have been carefully recorded for all patients. This book is the sum-up of what we learned during these ten years. Dr. Reha, Dr. Puthoda, Dr. Mudhafar, Heng, Silva, and thousands of villagers – without your efforts this book could not have been written.

Afghanistan

Dr. Assadullah Reha MD established Mujahed Medical Center in Jalalabad in 1989. For five years Dr. Reha and his team of doctors and medics gave life-saving first aid to more than 4,000 war victims. Every week Reha would give medical lectures and discuss case reports in tents and under the bridges in Jalalabad. Dr. Reha is the one who created the idea of Village Universities: systematic training programs in advanced life support for rural health workers.



Ehkalu and Hton Hton Oh at a Jungle University course.

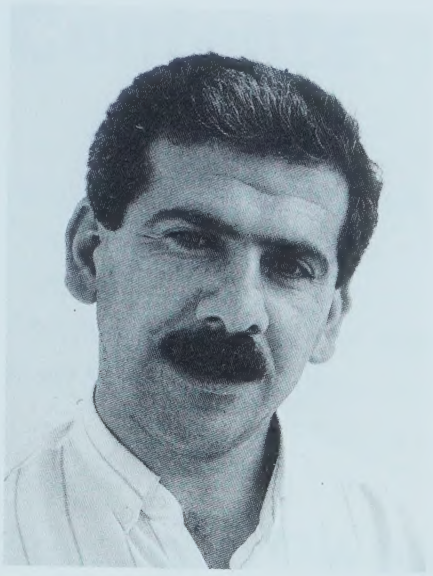
Karen State, Burma

Dr. Puthoda MD is a doctor, teacher, and organizer who is working with Karen National Union in Burma – one of the main parties of the Burmese democratic opposition. From 1992 Dr. Puthoda and the experienced military medics Ehkalu and Hton Hton Oh headed a group of 20 health workers from the democratic opposition in Burma. Since the coup in 1988 the military regime in Rangoon has placed mines and massacred villagers in the Burmese jungles. As the victims of these atrocities have no access to Burmese hospitals, Puthoda and his team have to carry them day and night in hammocks and river boats to hospitals at the Thai border. We can learn a lot from the achievements of our Burmese friends.

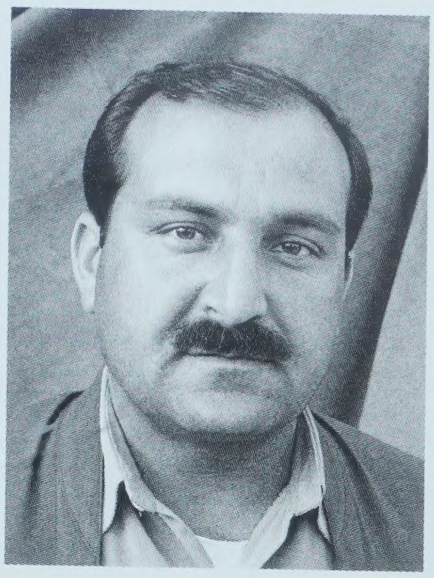
Heng, Rattana, and Dr. Chin Han.

Cambodia

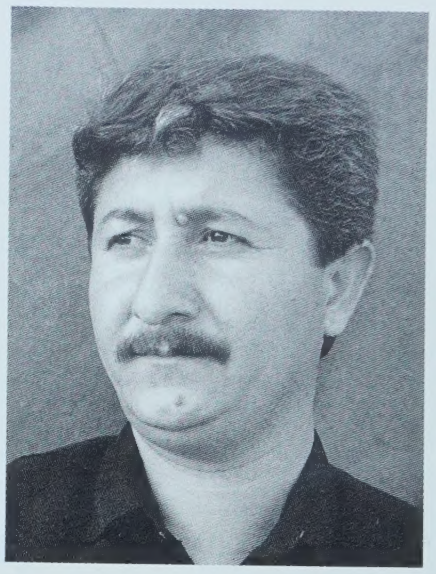
Yan Van Heng is the head of Trauma Care Foundation (TCF) in Battambang. Heng is an experienced Khmer medic and an outstanding medical teacher. Heng, Dr. Chin Han MD and the medics Rattana, Davvoung, and Bun Seut head a group of 40 medics working inside the vast mine belt in Western Cambodia. Besides having collected important medical data and photo documentation on hundreds of mine victims, Heng and his team have also developed excellent medical teaching aids. TCF in Battambang has particularly helped develop village training courses for first helpers.



Dr. Mudhafar Kareem Murhad



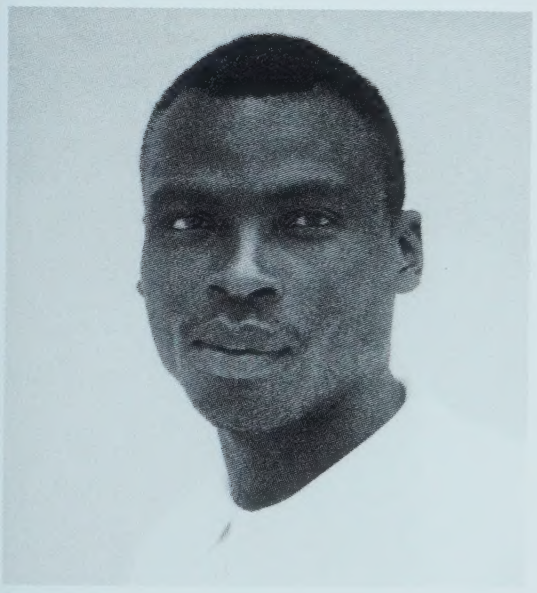
Osman Hama Salah



Qader Muhammad Salah

Kurdistan

Dr. Mudhafar Kareem Murhad MD heads Trauma Care Foundation in Suleimaniah, North Iraq. Together with Osman, Qader and a group of 20 mine medics they have rescued hundreds of mine and war victims from the mountains at the Iranian border. The management of mine victims in Kurdistan is more difficult than in most countries: The injuries are severe as there is a lot of bounding fragmentation mines. Also the winters in Kurdistan are cold and snowy, the roads are bad, and it takes a long time to carry the victims from the minefields to the hospitals. To get to the mine victim as soon as possible after the time of injury, TCF in Suleimaniah has trained "an army" of 3,000 village first helpers. In setting up chains of survival we are drawing on the experiences of Dr. Mudhafar and his team.



Silva Chissacanga

Angola

Silva Chissacanga has been working as a medic in mine-clearing operations in Angola for several years. Since 1997 he is the head of Trauma Care Foundation's 20 mine medics in Moxico, the most mine-infested province in Angola. To give life-saving first aid in Moxico's rural areas is not an easy job: The roads are mined, local clinics and hospitals have been destroyed. It can take days to get an injured victim to the hospital. Mines occupy fertile farming land. So, deprived of food and clean water, many Angolan victims are already weakened by malnutrition and diseases when they get injured. Silva and his team have made an important contribution to this book by the way they have tried to solve these problems.

Friends, this book is for you

You have been our teachers as much as we have been yours. Against enormous odds you have saved lives and limbs of innocent villagers injured by land mines and wars they never asked for. We all have a lot to learn from the way you solve problems, and from your decision to never give in.

This is your book.

Contents

Section 1: The body's response to injury

Section 2: Simple life support

Section 3: Advanced life support

Section 4: Case stories from real life

Section 5: The Chain of Survival

Section 6: The Village University

Some practical advise

About the authors, our methods, and results

Hans with Burmese student.

Hans is a surgeon with 20 years' experience in minefields and war zones. Hans' book *War Surgery, field manual* sets the standard for life-saving surgery in Third World countries. Mads and Torben are anesthetists and emergency medical doctors. Although we are all hospital-trained, we have worked mainly in life-saving first aid **outside hospitals.** We know from our experience of dealing with several thousand patients that early treatment means a better chance of survival, few complications at the hospital and a better outcome when the patient leaves the hospital – be it a mine-injured farmer or a child with acute diarrhea. This book applies Hans' basic principles of *War Surgery* to life support outside the hospital.

Other useful books:
See p. 204.

Lebanon: Too many die

Twenty years ago, the Israeli military repeatedly tried to crush the Palestinians in refugee camps and cities in Lebanon. At that time, the three of us were working in Palestinian hospitals together with excellent local doctors and nurses. But despite professional surgery and care, the outcome was truly depressing: Too many victims died in our hands soon after the injury. Too many died later on from complications and far too many wounds and fractures never healed due to infection. Why did all those seemingly healthy people with such a strong will to resist and survive end up dying? We thought of two possible reasons: First, they reached the hospital too late. They had been stuck in the ruins of their houses for hours due to the Israeli bombing, and suffered too much pain and blood loss by the time they finally arrived at the hospital. Second, although they seemed healthy they were not healthy: The Israeli siege of the cities had cut off supplies of food and clean water for weeks. At the time of injury, the victims were undernourished. So their bodies did not have enough strength to resist and heal the extensive wounds. We decided that in the next war we would work outside the hospitals.

Afghanistan: Early first aid saves lives

In Afghanistan the poorly equipped Afghan resistance and an even more poorly equipped medical service tried to cope with the huge, modern Soviet army. The only surgical hospitals for war- and mine-wounded Afghans were in neighboring Pakistan, days from where they were injured. Hans joined the Afghan resistance with the lessons from Lebanon in mind: The wounded start dying at the time of injury, and can only survive if they receive life-saving first aid and surgery immediately. In poor rural Afghanistan, where were the surgeons? There were none. So, we had to come to terms with the old hang-up that only qualified doctors can provide life-saving first aid and surgery.

Book born at Jalalabad

Jalalabad is an old city on the Silk Road from China to Europe. The battle for Jalalabad raged from 1989 to 1992. Together with Hans, 4 Afghan doctors and 12 nurses treated 3,800 war victims in tent clinics close to the battlefields. Of the 1,300 injured in 1989, one out of four died before they reached the hospitals in Pakistan (26%). That

was too many! So, we started training the nurses in modern life-saving first aid. We gave each a backpack with medical equipment, infusions, and drugs and told them to get to the injured **inside the battlefield** within 30 minutes after the injury. From that time on, only few victims died before they reached the hospital (13%). In 1989, 22% of the chest-injured died; when the nurses started to place chest tubes at the site of injury, only 6% of the chest-injured died. It is the papers and drawings from the training courses at Jalalabad that form the backbone of the book you are now reading.

Contents of the backpack: See p. 164 and 190.

Mads teaching at a jungle hospital.

Jungle University and "Burma Diet"

From 1993 to 1995 Hans and Mads worked with Aung Sann Suu Kyi's Democratic Coalition Government in Burma. We saw Burmese village health workers with little formal education doing their best to save the lives of farmers who had stepped on mines or had been wounded when army units from the Rangoon dictatorship massacred villagers. The Burmese jungle was the first place where we started systematic education of village health workers in life-saving first aid and surgery: We started learning-by-doing by treating injured animals, exactly as you will find in Section 6 of this book. We also learned in Burma how the patient's family, neighbors, and his village became part of the medical team: They assisted in setting up training camps and were blood donors and nurses. And they helped us set up the "Burma Diet", a very nutritious soup made in the villages from local foodstuffs. The "Burma Diet" helped the patients stay strong during the long journey to the surgical hospitals.

The Burma Diet: See p. 162.

orben at the Village University Kurdistan.

Mines and crocodiles: Early first aid works!

In 1996 we took the "university" from the jungles of Burma to some of the worst minefields in Cambodia, Kurdistan (North Iraq), and Angola. At local Village Universities inside the minefields we trained 80 local health workers using the lessons from Afghanistan and Burma. These 80 students then trained 6,000 first helpers in the villages – farmers and schoolchildren – on how to stop the bleeding from a mine-injured limb, and other simple and important life-saving measures. This large medical team of 80 expert medics and 6,000 helpers has now treated over 600 land mine victims. Each injury and the treatment is recorded, and reported to us at the university hospital in Norway where we use computers to analyze the results. And the results are really encouraging: At the site of injury the medics assess the severity of the injury on a scale from 0 to 12 points (0 = death, 12 = uninjured). The mean score in Cambodia and Kurdistan before the first aid treatment started was 8.5 points. Then the medics give continuous first aid all the way to the surgical hospital. When the mine victims reach at the hospital, the mean severity score is 10.5 points. Conclusion: With early and good first aid in the field, the mine victim is in a better shape when he gets to the hospital. And not only mine victims: the same goes for victims of traffic accidents, crocodiles, stabbings; and for blue babies, complicated deliveries, and patients with severe malaria and other medical emergencies.

Village first helpers: See p. 168-171.

Severity Scoring and quality control: See p. 80, 172, and 192.

We know from experience that the book you are now reading can help save many lives and limbs.

How to use the book

This is the chain of survival.
Read Osman's story on p. 18 and 36 to see how it works out in real life.

For all: first study Section 1.
If you are a medic treating mine victims, if you are a teacher training medics, if you are an organizer and want to set up medical services for mine victims: you have to know how different types of mines damage. You should also know how the body reacts when it is injured, how it tries to resist the injuries and heal the wounds.

Section 1, p. 16-37 gives you the basic knowledge on how the body reacts when we are injured – not only in mine injuries, but in all kinds of injury.

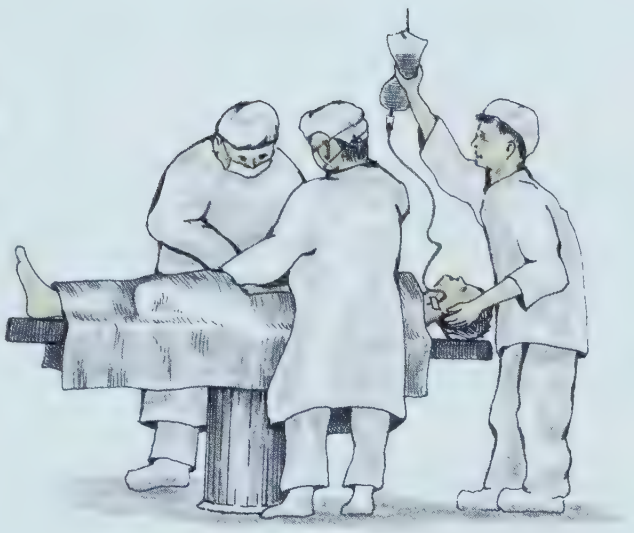
How to get the victims out from a minefield?
If the helpers are injured when they try to rescue a mine victim, you have not solved any problem – you have caused a catastrophe. Study p. 42 to find out how to manage.

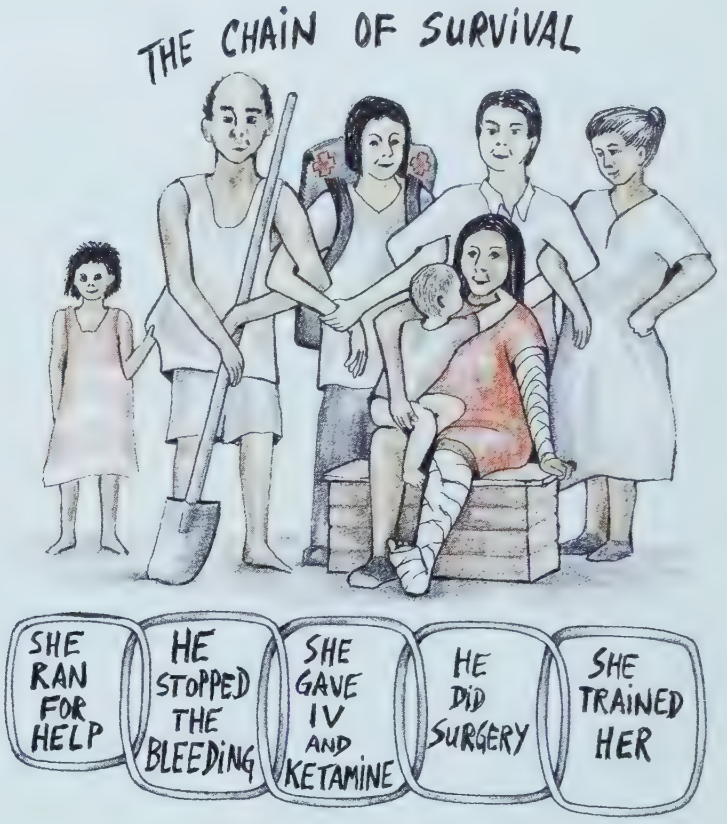
What is a first helper?
Mine victims – or any other severely injured people – start dying at the time of injury. They will only survive if they can breathe well and the bleeding is stopped. Such simple first aid must be given by the people who are there, at the injury site, in the village. These are the village first helpers. Study p. 168-171 to find out what first helpers should know, how you should train them, and what equipment they need.

The medical treatment we give immediately after an injury is not to repair the wounds, it is to help the victim survive. Such life-saving treatment is called **life support.**

Simple life support: see Section 2, p. 38-83.
Here you find the most important life support measures illustrated and discussed in detail. If you know these measures, you can help most victims.

Advanced life support: see Section 3, p. 84-107.
Some of the severely injured need more than simple life support. This is especially so for injuries to the face, the chest, and the abdomen. Nobody should do advanced and complicated things unless they are specially trained for it, and have the necessary equipment ready. So, the yellow pages and yellow text in the book are only for specially trained health workers.





Life support must continue all the way to the hospital. Study p. 78 to find out how that can be done.

If the hospital is far off, or the victim is undernourished, he needs food during the transport. Study p. 66 and 162 to see how nutritious soups can be made from local foodstuff.

What do you need in drugs, infusions, and equipment? Study p. 140 and 164.

We must always record the treatment we give and how the patient reacts. Study p. 80 and 172. to see how medical documentation can be done in a simple way.

The hospital is one link in the chain of survival. For a chain to be strong, all links must be well connected. So, as a medic working with life support in the field, you should co-operate closely with the hospital.

You should study the outcome of the hospital treatment, to find out if the life support you gave in the field really helped the victim. Hospital charts and quality control: See p. 172.

This book is useful for those working in the emergency department at surgical hospitals, particularly Section 3. But surgery and medical care inside the hospital are not discussed in this book. For that, you should study "War Surgery, field manual" or other books recommended on p. 204.

If you are an organizer and want to set up health services for mine victims: **Section 5, p. 126-143,** explains step-by-step how you can set up such a program.

Giving medical treatment is a heavy responsibility, mistakes can cause severe problems and even death. Study **Section 6, p. 144-175,** on selection of students, training in life support and certification.

Section 4, p. 108-125, contains true case stories to show how life support can be given under difficult circumstances. Use these stories when you study Sections 2 and 3 – be it at home or at the Village University. Real-life practice is our best teacher.

Keep in mind: While you study this book, every 10 minutes a person somewhere is injured or killed by a mine.

Points to note – Section 1

This is where you should start your studies
Section 1 is on how the body responds to injury. We should not look at the wounded body in the way traditional medical textbooks tell us: by dividing the patient into separate organ systems. Our body and our soul is a united whole. **There is one common goal for all of the body's defenses:** to get enough oxygen to all parts of the body, especially the injured parts. That's why Section 1 is about oxygen.

Good life support means helping the body's defenses
We, the authors, have seen a lot of land mine and wartime injuries. We have seen the severely injured survive days of rough transport and get to a hospital. We have come to admire the enormous strength of the body's own defenses and its ability to survive. We health workers are not the real life savers. We are only helpers. To be a good helper, you have to know how the injured body defends itself. This is what Section 1 is about.

Have you understood Section 1? Then you can proceed
After the first nine chapters, on p. 36, you will meet Ahmed the herdsboy again. His progress from the injury site to the hospital, and then back to the village is now recorded on a Severity Score table. If you can understand that chart, then you know how to find out if the injured body is getting enough oxygen. This means you already understand a lot, and can go on to Sections 2 and 3 to learn about the details of life support.

Section 1:

The body's response to injury

Oxygen is life! At sunset Ahmed the herdsboy is walking the cattle back to the village. He is alive because all the cells in his body are getting oxygen.

Oxygen is life – oxygen starvation is death

Oxygen is in the air around us. Oxygen is a gas without smell and color. In breathing, we suck air rich in oxygen into the body. In the mountains of Kurdistan the air is cool, fresh, and contains plenty of oxygen. Ahmed was breathing deeply. He was happy, thinking of his mother and warm fresh bread at home.

See Ahmed's story on p. 2.

The airway is open. The airway is the tube that allows oxygen to get to the lungs. It has two parts:

- The upper airway – Nose and mouth, throat, and larynx
- The lower airway – Trachea and the right and the left bronchus.

Use the Glossary p. 213 to find difficult words like larynx and bronchus explained.

The lungs are working. The lungs act as a suction pump, thanks to the movement of the diaphragm:

- Breathing in. When the diaphragm contracts, it moves down into the belly. The diaphragm pulls on the lungs. This makes the lungs expand and oxygen is sucked through the airway into the lungs. Inside the lungs oxygen enters the blood vessels. Normally adults take 10-30 breaths each minute – we say **the breathing rate** is 10-30/minute. Injuries, pain, and fear increase the breathing rate.
- Breathing out. Inside the lungs waste products from the body pass from the blood vessels into the air. When the diaphragm relaxes and moves up into the chest cavity, the lungs are compressed. This causes the air with waste products to be squeezed out of the lungs.

See drawing on p. 29.

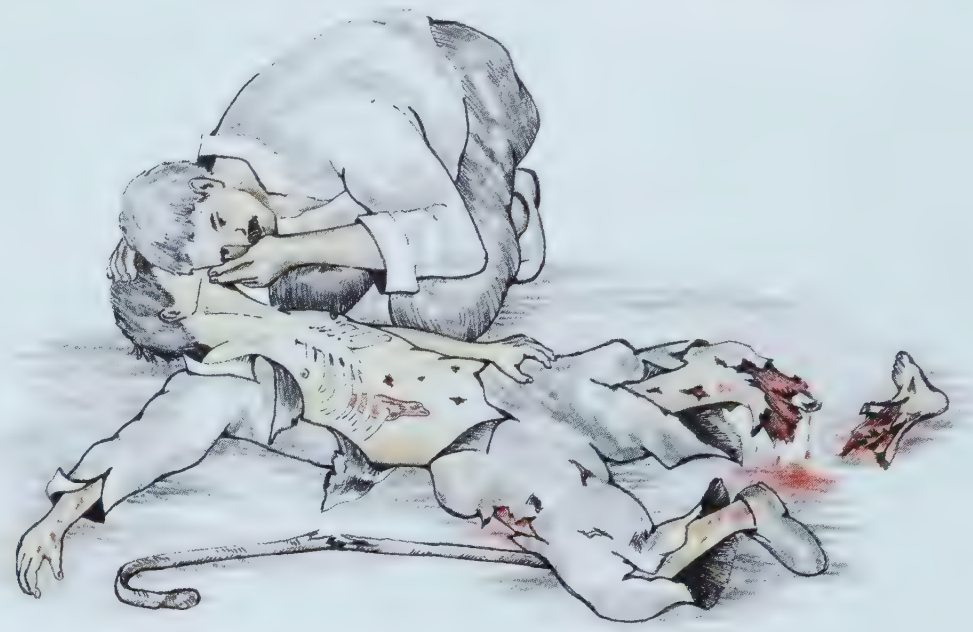
The blood circulation is working. The flow of the blood through the body is called the blood circulation. The blood carries oxygen from the lungs to all the cells in the body. The blood circulation is made of three parts:

1. **The heart** is a strong muscle which acts as a pump. When the heart contracts, it squeezes blood with oxygen through the blood vessels. When the heart relaxes, it fills up with blood. Normally an adult's heart beats 60-80 times each minute – we say **the heart rate** is 60-80/minute. You can count the heart rate by placing your fingers on the big blood vessels at the neck (the carotid pulse). **The systolic blood pressure** is the peak pressure inside the blood vessels when the heart contracts. Normally the systolic blood pressure in adults is around 120 mm Hg.
2. **The blood vessels.** Blood is pumped into all parts of the body through tubes called **arteries,** and flows back to the heart through tubes called **veins.** The walls of the arteries have muscles which can contract and reduce the blood flow through the arteries.
3. **The blood** is a liquid made of water, salts, proteins, red blood cells, white blood cells, and platelets. The red blood cells form "the transport system" to carry oxygen. When Ahmed is losing blood, he also loses millions of red blood cells. So his blood can carry less oxygen. The platelets are small pieces of tissue flowing in the bloodstream. The platelets seal leaks in the blood vessels. If the patient is cold (body temperature less than 34° C), the blood platelets don't work properly. The white blood cells fight infections.

To measure the blood pressure: See p. 186.

Oxygen starvation is death

When he stepped on a VS50 blast mine, Ahmed started dying. The villagers heard the explosion. After 30 minutes of searching, they found him a few meters to the side of the path. *Ahmed!* they shouted. But Ahmed did not respond, he was unconscious. They dragged Ahmed to the path and examined him.



Airway block causes oxygen starvation

There is no use having good breathing and good blood circulation if the airway is blocked. You can live for 5 days without food. But you cannot live for 5 minutes without oxygen, not before your brain is permanently damaged. Hence, a blocked airway must be opened immediately. It is a question of seconds!

Reasons for airway block may be:

- In weak and unconscious patients like Ahmed, the tongue slips into the throat and blocks it.
- In weak patients like Ahmed, vomit from the stomach or blood from face wounds enters the airways and blocks it.

This is life support to Ahmed:

- Move the tongue forward by tilting the head backward and lifting the chin.
- Prevent vomit from blocking the airway by placing him in the recovery position.

or more: See p. 28 and p. 46.

Poor breathing causes oxygen starvation

The village first helper opens Ahmed's airway by tilting Ahmed's head backward. Then he places his ear close to Ahmed's mouth. He can feel and hear Ahmed's warm breaths in his ear. So Ahmed is alive! But there is little use of an open airway if the breathing is not good. Ahmed is breathing very rapidly. The villager counts the breathing rate: It is 35/minute – that is too much! Rapid and shallow breathing is poor breathing.

Reasons for poor breathing may be:

- Pain and fear. Ahmed has much pain – even if he is unconscious.
- Injury to the chest. Blood and air collect in the chest cavity and compress the lungs.
- Injury to the belly. The diaphragm cannot move freely. Ahmed has fragment wounds in his belly

This is life support to Ahmed:

- Comfort and encourage him: Hold his hand, talk to him, be close to him.
- Pain relief. Get him to the medic as soon as possible so that he can get IV ketamine.

For more: See p. 29 and p. 48.

Poor blood circulation causes oxygen starvation

So, Ahmed's airway is open and he is breathing. But he is losing blood! The villagers can see blood flowing from the amputation wound. And there are also fragment wounds in the thighs and the belly – he may be bleeding inside.

Signs of poor circulation are:

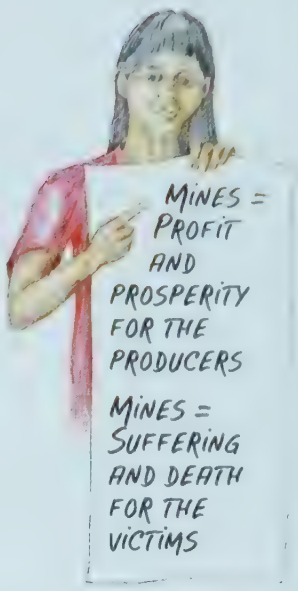
- Moderate blood loss. The pump works harder – the heart rate increases. The villagers count Ahmed's heart rate at 140/minute – very fast!
- More blood loss. The arteries to the limbs contract – the skin is cool to touch.
- Even more blood loss. The pump cannot maintain the normal pump pressure – the systolic blood pressure starts falling. If the villagers could take the blood pressure, they would find it at 80 mm Hg. Ahmed's blood circulation is close to collapse!

This is life support to Ahmed:

- Stop the bleeding – one helper presses on the main limb artery at the groin and lifts the injured leg. The other packs cloth into the amputation wound and dresses the whole leg tightly with elastic bandages.
- Keep him warm – cover him with clothes. Hold him close to yourself during the transport.
- Replace the blood that he lost – get him to the medic urgently. He needs warm IV infusions.

For more: See p. 30 and p. 50-57.

Fragmentation mines



There are three types of anti-personnel mines

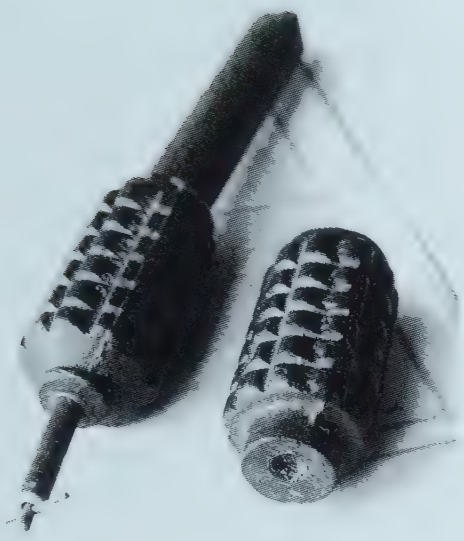
A young Cambodian mine victim.

- **Fragmentation mines** are the worst killers of all mines. They shoot showers of high-speed steel fragments that can kill anyone within 100 meters. Often more than one person is hit. Normally the victims are hit by more than one fragment.
- **Blast mines** damage in two ways: (1) The blast wave tears off parts of a limb. (2) Fragments from the mine case and stones from the ground are blasted into the victim. There are more victims from blast mines than from fragmentation mines. This is because blast mines are cheaper, and so more blast mines have been planted.
- **Anti-tank mines** are also mines which kill people. The anti-tank mine cannot tell the difference between a military vehicle and a civilian bus. Angola has lots of civilian victims from anti-tank mine accidents.

All types of mines can be coupled together in a series so that several mines fire together.

More on blast mines:
See p. 24.

The fragmentation mine



The POMZ stake mine.

It is made of a core of high explosive covered by pre-formed steel fragments. When the mine fires, the fragments are shot in all directions at speeds faster than a rifle bullet. Fragmentation mines are placed on the ground, not in the ground like blast and anti-tank mines. Fragmentation mines are normally released by tripwires. Thin threads 5 -15 meters long are attached to the mine. The mine fires when the victim touches one of the tripwires.

POMZ – the stake mine

Manufacturing countries: China, Russia, and their former allies.
Target countries: Types of the POMZ are found everywhere.
How it is made: 75 g of TNT with a sleeve of 40-60 heavy iron fragments.
How it works: The POMZ is placed on a wooden stake hidden in the grass. The load of explosive is low, so the speed of the fragments is low compared with other fragmentation mines. The mine makes few fragments so the risk of multiple (many) wounds is low. But the fragments are heavy and go deep into the body. The stake mine can kill anyone within 50 meters.

PROM-1 bounding mine is a smart devil: When released this mine waits 2 seconds before it jumps and explodes, so that the victim is not blocking the jump. This allows it to hit more people and cause more injury.

The bounding fragmentation mines – jumping mines

Manufacturing countries and target countries: There are many brands of jumping mines. They all work the same way and have the same killing capacity.

- M16: Made in USA. Used anywhere, especially in Cambodia, Angola, Iraq, and Lebanon.
- Valmara 59 and 69: Made in Italy, South Africa, and Singapore. Used everywhere, especially in Iraq.
- PROM-1: Made in former Yugoslavia. Common in Namibia, Eritrea, and Ethiopia.

How it is made: The mine itself contains 400-600 g of high-explosive surrounded by several hundred small steel fragments

embedded in a soft plastic sleeve. The mine is contained in an outer case with a propelling charge. This charge is released by a tripwire, so that the mine jumps up from the case before it fires.
How it works: The speed of fragments is around 1,200 meters/second, much higher than the speed of a rifle bullet. Bounding mines can kill anyone within 100 meters. The fragments spin in flight and make very bad wound tracks. Normally several people are hit, each of them by many fragments.

Injuries from fragmentation mines: Also see photos on p. 23, 24, 26, and 45.

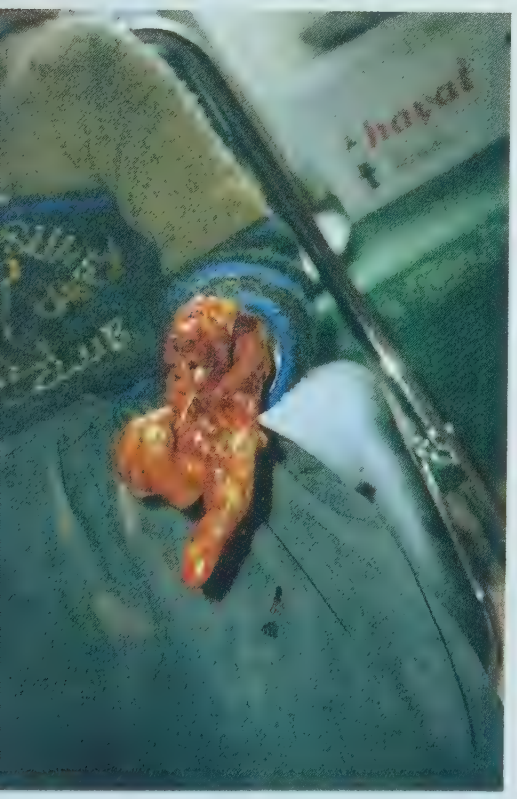
Improvised fragmentation mines – grenade mines

Manufacturing countries: All countries that produce hand grenades, mortar bombs, or artillery shells.
Where they are used: These mines are home-made everywhere. In Cambodia and Angola they are the most common type of fragmentation mine.
How they work: The fuse is tripwire-released. Modern hand grenades can have 1,000 steel fragments weighing 0.2 g, flying at 1,500 meters/second, with a killing range of 50 meters. Mortar and cannon ammunition produce heavy fragments (up to 15 g) with a speed of 1,500 meters/second. These fragments go deep into the body and cause terrible damage and the killing range is even larger.

Bombies, the type used by the US in South-East Asia and recently by NATO in Kosovo.

BLU72 – bombies or ball mines (cluster bombs)

Manufacturing country: USA
Target countries: Placed by the US during the blanket bombing of Laos, Vietnam, and Cambodia and by Israel bombing Palestinian refugee camps in Lebanon.
How they are made: Each "mother bomb" is dropped by airplane and contains hundreds of small bombs (bombies). The mother bomb opens above the ground and spreads its bomblets. Each bombie has a core of explosive covered by hundreds of small steel fragments.
How they work: The bombies fire after a certain number of rotations. Either above the ground or on hitting the ground, they produce a 5,000-square-meter shower of fragments. Or they act as a mine and fire when a child starts playing with them. The fragment speed is 1,000 meters/second, and the killing range is up to 50 meters.



He played with a bombie, March 1998.

The force of fragments and bullets depends on their speed

The manufacturers of mines try to increase the speed of the mine fragments. Why? Simply because they want the mine to kill and injure more people.
Why is the speed so important? If you throw a light stone at someone, it hurts. If you throw it again, but at double the speed, it hurts the person much more! **In fact the force increases 4 times when the speed is increased twice.** The force only doubles when the weight is doubled. This is a law of nature.

Always take the weapon history:
- Type of weapon/mine?
- Distance from the gun/explosion?

How fragmentation mines injure

Common distribution of injuries from fragmentation mines

Injury to the limbs	30%
Injury to the head	10%
Injury to the chest	15%
Injury to the abdomen	15%
Several severe injuries	20%
Superficial injuries	10%

Death rate: around 30% even with good life support.

More patients die from fragmentation mines than from blast mines. Of 10 patients injured by fragmentation mines, 6 have injuries to important organs. Many victims are hit by two, three or more fragments. The body may be able to survive one severe injury. But two severe injuries at the same time are far more dangerous.

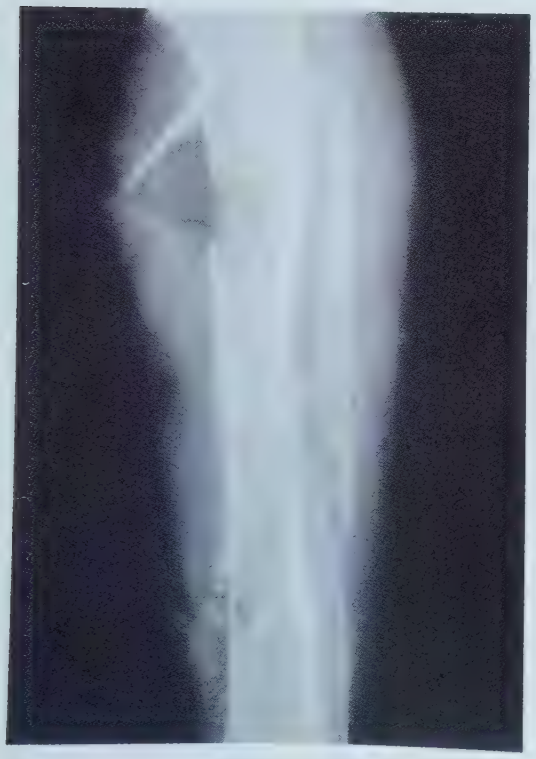
Fragment injuries to limbs

Although the inlet wounds look small, the damage inside can be massive: A stone hitting water makes waves. Our body is 70% water. A mine fragment sends pressure waves into the tissues. The waves are very fast and hit the tissues like a blow. How the tissues are damaged depends on how elastic they are (how easily they stretch).

- The skin is very elastic. It stretches when the fragment passes through and then springs back without much damage.
- But muscle is not very elastic. The pressure waves tear a wide and ragged wound track through the muscle. Because muscles have a rich blood supply, muscle wounds bleed a lot.
- Bones are not at all elastic. When a fragment hits bone, the fragment is suddenly brought to a complete stop. Exactly at that point a massive pressure wave is formed. The wave hits the surrounding tissues like the splash from a flat stone hitting water. All the force carried by the fragment becomes tissue damage.

See drawings p. 27.

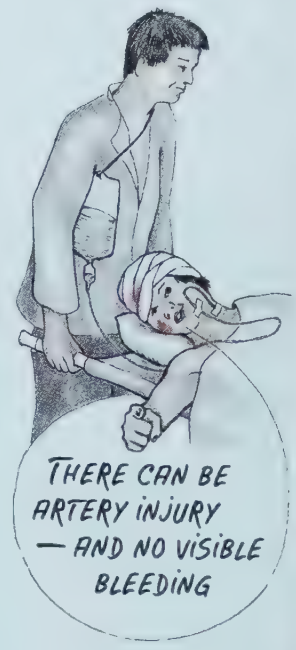
The legs of a 12-year-old Palestinian girl hit by bombie fragments, Beirut 1982.



The hidden injury: X ray of the girl's leg shows extensive internal damage. You cannot assess how serious an injury is just by looking from the outside.

Artery injuries

Fragments from the mine or pieces of bone may tear the wall of the artery. Small tears are plugged by platelets and don't bleed a lot. Wide tears bleed a lot. But note – the artery bleeding is hidden! Because the wound track is narrow you will seldom see blood pumping out through the limb wound. Still 1-2 liters of blood may collect inside the limb. Then – as a result of the blood loss – the blood stream inside the artery slows down. The platelets plug the artery tear and the bleeding temporarily stops. When you arrive at the site of the injury, the patient is not bleeding. This may fool you. If you start IV infusions without having packed the wound track with gauze or clothes, the blood clot in the artery will be flushed away when the blood pressure rises, and the wound will start bleeding heavily. Therefore you should know the signs of artery injury.



The signs of limb artery injury

In all artery injuries the limb is cold: Compare the skin temperature of both limbs. Weak or absent pulse below (distal to) the wound is not a reliable sign.

Fractures bleed a lot

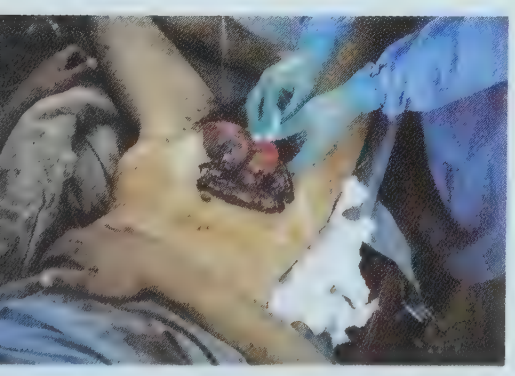
Fractures bleed from the bone marrow and from torn blood vessels running close to the bone. There can be a lot of blood inside a swollen fractured limb.

Pooled blood at fractures (estimates)

Arm fracture	1 L
Forearm fracture	0.5 L
Thigh fracture	2 L
Lower leg fracture	1 L

Afghan boy hit by grenade fragments. Even small skull fractures may cause brain damage.

One fragment can cause multiple injuries: combined injuries to the chest and abdomen are common.



ffects of a POMZ mine on an fghan farmer. Read his story n p. 94.

Fragment injuries to important organs

Injuries to the skull mean airway problems: As most victims with severe head injuries die within an hour in the field, we can do nothing to save them. For those who survive more than one hour, blocking of the airway is the main problem:

- In drowsy and unconscious victims, the tongue slips backward and blocks the airway.
- If the victim vomits but is too weak to cough, then vomit enters the lower airway and may block it.

Note that the symptoms may come on slowly during the journey to hospital. That is why head-injured victims who are not fully awake and clear should be carried in the recovery position.

How to protect the airways: See p. 46.

Injuries to the face mean airway problems: The blood supply to the face is rich, so face injuries bleed a lot. Often there is associated brain damage, so the patient is weak and cannot cough properly. This is why blood or bone fragments may block the airway.

See case story from Angola, p. 112.

Injuries to the chest mean breathing problems and sometimes problems due to blood loss: Most victims who are hit in the middle of the chest die within one hour from tears of the heart or major blood vessels. Most patients hit at the sides of the chest survive if the life support is good and starts early. The main problem is not the lung injury itself: The lungs are very elastic and can take a fragment wound without much bleeding. The main problem is the fragment wound in the chest wall: Blood from broken ribs and torn rib arteries collects between the lung and the chest wall and compresses (squeezes) the lung. Air leaking from the lung and through the chest wall wound also makes the lung collapse. This causes poor breathing – and the body suffers from oxygen starvation.

Chest tube drain is life-saving: See p. 90-93.

Injuries to the abdomen mean blood loss and poor breathing

Blood loss: The villagers saw the wounds on Ahmed's belly but they could not tell if blood was pooling inside. There are so many blood-rich organs inside the abdomen such as the liver, kidneys, spleen. The main signs of injury inside the abdomen are the signs of blood loss: The victim's limbs are cool, the heart rate increases, the blood pressure falls, and the victim becomes drowsy. You may think that the belly will swell if there is bleeding inside. This is not true. The abdomen can collect 2-3 liters of blood without showing any swelling.

See Ahmed's story on p. 2 and 18.

Poor breathing: Injuries to the abdominal organs block the movement of the diaphragm. This means that the lung suction pump cannot work properly. So, besides having less blood circulating around the body, the blood also carries less oxygen due to shallow breathing.

How to support the breathing: See p. 48.

How fragmentation mines injure – in brief

More than one wound: Each victim may have several injuries. Don't miss any fragment wound, undress the victim completely!

"Hidden" injury: Even if the entry wounds are small, the injury inside can be severe. Increased breathing rate, increased heart rate, and a cold limb are the main signs of severe internal injury. Never say "it's just a superficial wound" without having examined the victim carefully.

Blast mines and anti-tank mines

A farmer's limb lost to a PMN blast mine. Afghanistan, May 1990.

The blast mine

There are far more blast mines than fragmentation mines in the world. Blast mines are not as powerful a killer as fragmentation mines. But they are easy to make "in the kitchen" and they are very cheap. In local war zones you can get one PMN mine for US$4 or three PMNs for US$8. Blast mines have a case with high explosive covered by a pressure plate. They are placed on the ground covered by soil or grass, or they are buried in the ground. They can be placed one by one, coupled in series, or as clusters. The mine explodes when the victim steps on it with a pressure of 1-15 kg. A child's foot is heavy enough. Some blast mines also have an anti-disturbance mechanism. They explode when the mine is tilted a little, they are designed to kill mine clearers. Most blast mines also work underwater.

Injuries from blast mines: See p. 26.

Blast mines injure in two ways:

- **The blast wave.** The explosion inside the mine is extremely rapid and makes a pressure wave – the blast wave – which moves at 3,000 meters/second in all directions. The pressure of the blast wave from a PMN can be 2 kg per square cm – that is the same as being hit by a truck! The blast wave may tear off limbs, and also cause severe internal injury.
- **Fragments.** Pieces of the mine case (metal or plastic), stones and dirt, pieces of the victim's shoes and parts of his own limb are shot as high-speed fragments in all directions. So, if the amputation caused by the explosion does not kill, the flying parts of the amputated limb may kill the victim.

"The hidden wound": See p. 27 and 100.

Made to kill mine clearers: Type 72C made in China-UK.

Light blast mines (30-50 g high explosive)

The force of the blast wave and the speed of the fragments depend on how much explosive is loaded into the mine. Light blast mines can tear off a forearm or a leg at the ankle. Here are a few examples:

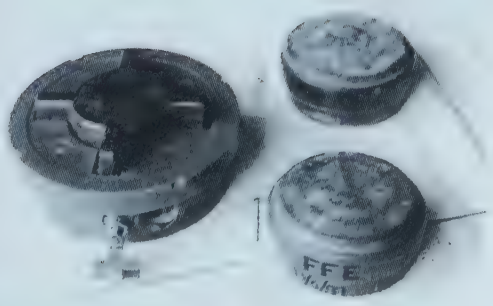
Type 72 is manufactured in China and South Africa. It is found everywhere. The mine is made of plastic and is difficult to find with metal detectors. Type 72C has an anti-tilting mechanism bought by China from Motorola UK. Prodding can release a 72C mine. It is a killer meant for mine clearers.

M14 is a US-made plastic mine. Copies are made in India and Vietnam. M14s are found everywhere. There is very little metal in this mine, so it is very difficult to detect.

SB33 is a sophisticated Italian production. Copies are made by other EU countries as well. SB33s can be placed by hand or scattered by artillery or helicopter. The mine is very difficult to see on the ground – it is small (9 cm), flat like a stone, and has perfect camouflage colors. This mine has a pressure fuse which stops mine clearers from blowing it up with TNT. Yet the mine can explode with the 10-kg pressure from a child's foot.

Heavy blast mines (150-200 g high explosive)

Heavy blast mines can tear off an arm above the elbow or a leg through the thigh. And they can blow up a car.



One PMN (left) and two 72s.

PMN – "the World's No. 1" mine! No other mine has cut off more limbs and killed more farmers, women and children. The PMN is a Soviet design now copied by many countries. The explosive weight is 200 g, making it the most potent of the blast mines. The mine is heavy (0.5 kg) and works well underwater.

VS50 is an Italian design copied by several countries. It is common in Africa, Kurdistan, and Afghanistan. Like its "small brother" the SB33, it is difficult to find with metal detectors. It cannot be blown up on-site with TNT by expert mine clearers, but the pressure from a child's food will make it explode.

No. 4 – the Israeli box mine is used in Lebanon and exported to many African countries. This mine is very deadly and holds 190 g TNT. It can be set to explode with pressure from 1 kg upwards.

Home-made blast mines

Most of them are wooden box mines. Any type of tripwire or pressure fuse works. The mine is armed when a hinged lid is lifted. The lid rests on a pin at the end of the fuse. When the pin breaks – at pressures from 1-10 kg – the mine fires. The maker of the mine decides its explosive weight. With 200 g of TNT it can destroy vehicles as well as people. Old wooden box mines are extremely unstable and can be released by ground vibrations.

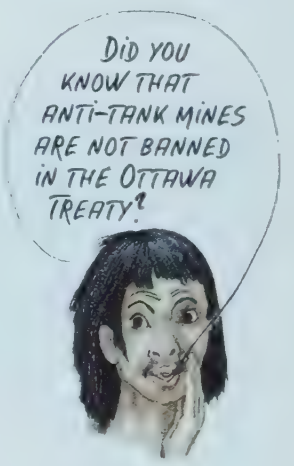
Blast mine amputation in a Cambodian farmer, 1997.

Anti-tank mines are also anti-personnel mines (mines which kill people)

Anti-tank mines are deliberately placed to destroy civilian vehicles. If they are placed in wartime, they are seldom cleared and continue to kill when the war is over. In some wars (Bosnia, Mozambique, Angola) there was an excess of anti-tank mines, so they were placed in fields and on paths and used as blast mines to kill people. Anti-tank mines are normally booby-trapped: Anti-personnel blast mines are placed around the anti-tank mine to kill any mine clearers. There are two classes of anti-tank mines:

- **The light anti-tank mines** like the Italian VS2.2 and TC2.4. They contain 2 kg of high explosive. This is not enough to destroy a tank, but enough to destroy a bus. The release pressure is 180 kg, but this can be adjusted down to 50 kg. Like other Italian mines, they cannot be detonated on-site by mine clearers, and have to be disarmed by hand. The Italians do heavy marketing and these mines are found everywhere in the Middle East.
- **The heavy anti-tank mines** contain 6-8 kg of high explosive. That is enough to throw a bus 10 meters off the road. The most common brands are the Type 72 made in Japan and the TMN46 which is manufactured in many countries. Both can be booby-trapped, both work well under snow and underwater. The Type 72 is the most common anti-tank mine in Kurdistan.

His other leg with fragment njury to the femoral artery. Of three victims with mine amputations, two have also severe fragment injuries.



The remnants of a bus that hit an nti-tank mine. In Angola trucks re used as buses.

Injuries by anti-tank mines are terrible

Anti-tank mine accidents involve mass casualties:

- Severely injured victims have to be left aside to die – those with less severe injuries have priority.
- Crush injuries and blunt injuries are common.
- The wreck is set on fire, so burns are common.
- Victims are trapped inside or under the wreck.
- Stones, pieces of the mine case, and parts of the vehicle cause fragment injuries.

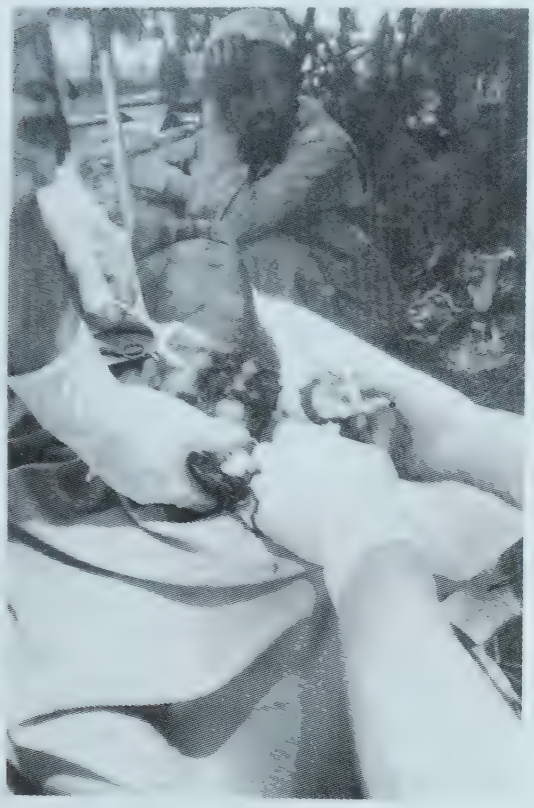
See case story from Angola on p. 124.

How blast mines injure

Beware the fragment wounds. A tiny fragment can kill at close range.

Job no. 1 – save the life: Beware of fragment wounds

Many people think that a blast mine injury is an amputation injury – and that's it. People from the minefields know better: They see blast mine victims dying on the way to hospital, not from amputation bleeding, but from fragment injuries. Amputations in the lower part of the limbs seldom bleed much. However, high-speed fragments from the mine, the ground, or pieces of the limb can hit the victim anywhere. Look especially between the legs: A fragment may penetrate from here into the belly. These are the wounds which kill. The bleeding amputation wound is less dangerous, it is easier to find and easier to treat.



Afghan farmer with blast mine amputation at the ankle. He really needs what is left of his leg!

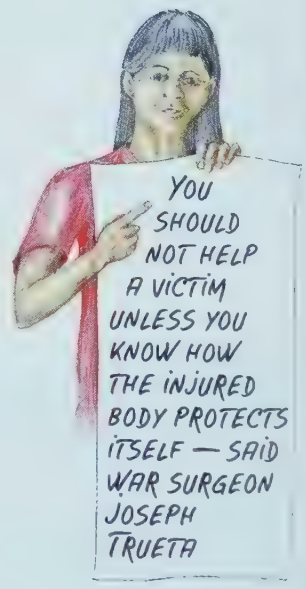
For most mine victims artificial limbs are a dream. Job no. 2 – Save every centimeter you can of the amputated limb

Most amputees in poor communities do not get artificial limbs. Child amputees need to have a new artificial limb fitted every second year. That is beyond the reach of a poor farmer's family living far away from the city. We care for the farmer. So our job is to take care of the injured farmer and get him to the hospital alive. Our job is also to get the farmer back to the village with as long an amputation stump as possible. He can feed his family and have a decent life with a below-elbow stump. And he can drive his oxen with a good ankle stump. But with a short arm or leg stump and no prosthesis, he cannot support his family. Traditional farming in poor communities is labor-intensive, so all family members have to take part. To have one key family member lose a limb is the same as having the entire family lose their limbs. The family's only future may be as big-city beggars.

Cambodian farmer at Phnom Penh Military Hospital. The mine tore his feet off, the surgeons took the rest.

Stop chopping off limbs. There is no such thing as an "ideal level of amputation"

The present situation is a tragedy. Most blast mine survivors arrive at the surgical centers after hours or days with oxygen starvation, in pain, and without nutrition. Many of them have had tourniquets that shut off the limb blood supply and damaged what the mine left undamaged. Next, many overseas surgeons on brief "mine victim assistance" visits to poor countries chop off the injured limb at preset "ideal levels" to make amputation stumps fit a "standard prosthesis". With good life support in the field without tourniquets and caring surgeons at the hospital, the same farmer may have been able to continue farming with a good ankle stump (without need for a prosthesis). So, even though he only lost 15 cm of the foot to the mine, our farmer ends up losing the entire limb to the "health" workers.



It is a problem when the amputation wound doesn't bleed

Most mine amputations are due to light blast mines. In both upper- and lower-limb amputees, the mine amputates the victim at or below the wrist or the ankle in 2/3 of the cases.

The amputation wound is ragged and extremely dirty. Soil and pieces of shoe and cloth are shot into the soft tissues around the wound. This makes a good base for wound infection. The blast wave crushes blood vessels and muscles – dead tissue is an even better base for infection. But the main problem is that most low-level amputation wounds do not bleed. Without a blood supply to the wound, white blood cells that eat bacteria and dirt and red blood cells carrying oxygen have no way to reach the wound. A poor blood supply is the main cause for wound infection and unnecessary loss of limb length.

Why amputations don't bleed: There is a "hidden" wound in the muscles

The blast wave from a mine travels along the bones from the level of amputation into the limb above. To get an idea of how it works: put your ear to a long steel tube and let your friend hit the tube at the other end with a hammer. The bang hits your ear and it hurts. The pressure wave from the hammer travels along the tube just like the mine blast wave inside the limb. The blast wave enters the surrounding soft tissue from the bone and causes a "hidden" wound in the muscles. This is how the **hidden wound** develops:

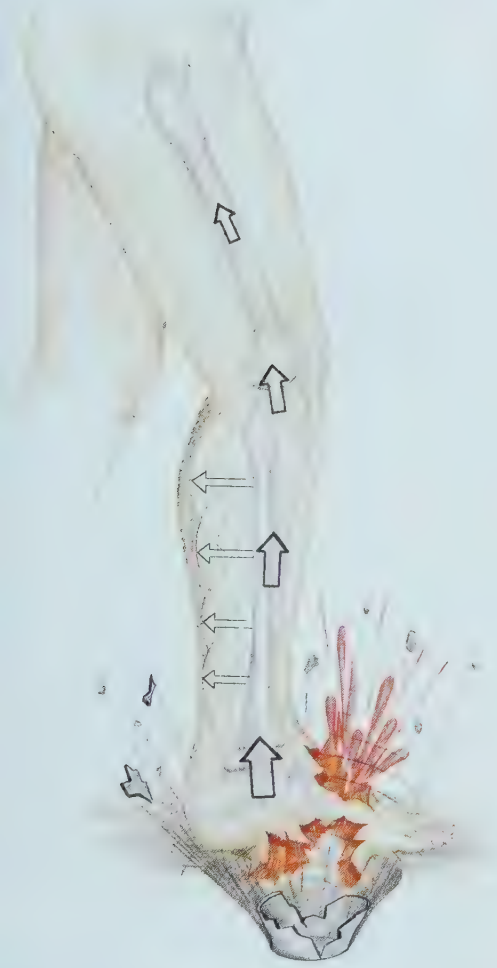
- Muscle is crushed and starts swelling.
- Blood vessels are torn and start bleeding inside the limb – increasing the swelling.
- Arteries are stretched and become blocked.

But the muscles in the foot, lower leg, and hand are enclosed inside tight fibrous sheaths (the muscle fascia). So swelling in these limbs causes more pressure inside the muscle. This compresses the blood vessels and reduces the blood supply to the amputation wound even more. When you split the muscle fascia (fasciotomy), the pressure will immediately fall and the blood flow improve.

More on "hidden" wounds and fasciotomy: p. 100-103.

Note that the skin is not damaged! The skin is elastic (stretches easily) and can take the shock from the blast wave without tearing. That is why we call it a "hidden" wound. When you look at the limb above the amputation, it seems uninjured. But if you looked under the skin, you would find a major swollen wound that blocks the blood supply to the amputation wound below.

See photo of the Afghan farmer on p. 24: There is a large muscle wound in his lower leg, but the skin seems normal.



The "hidden" wound:
The blast wave travels inside the victim's limb like waves in water. It spreads from the bones into the soft tissues, and crushes muscles and blood vessels.

Blast mine injuries – in brief

First, life support for the fragment injuries:

- Open the airway. Support the breathing. Give pain relief.
- Stop the fragment wound bleeding if possible. Give warm IV infusions.

Then, limb support for the amputation injury:

- Stop the bleeding from the amputation wound by gauze packing. But don't use tourniquets!
- If it takes more than 4 hours to get to the hospital – do fasciotomy in-field!

Why tourniquets should be banned: see p. 32 and 50.

Life support: Airway and breathing

Life support for a mine victim, Cambodia 1999.

What is "life support"?

Do you remember Ahmed's story? Remember how he survived severe injuries thanks to good life support by his fellow villagers? The more you see of terrible mine injuries, the more you will come to admire how the human body can resist and survive the injuries. When you work in poor communities with little medical equipment to help you, it is very important that you help the injured person's body resist and survive the mine injuries. The health worker is not a hero, but a helper. To be a good helper, the first thing you have to know is how the body responds to injuries.

On Ahmed: See p. 2 and 18.

The basic response to injury: "I need more oxygen!"

When you are healthy and run for the cattle, you start breathing rapidly and deeply, and also your heartbeats are faster and stronger. Why? To increase your strength, the body needs more oxygen. It is exactly the same for the mine victim. Nerve signals from the injury make the victim try to get more oxygen. This response comes immediately after the injury. There is a great need to get more oxygen into the body:

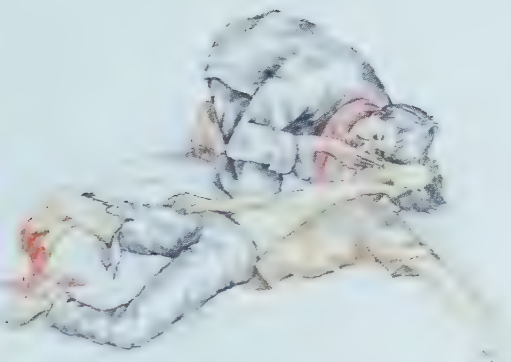
- **The breathing rate (RR) increases.** The patient takes more breaths/minute. Your own RR when reading this is probably around 15-20 breaths each minute. If the mine victim has lost a lot of blood or he has a chest injury, the RR may increase to 30-40 breaths each minute.
- **Each breath is deeper.** The lungs act as a suction pump. The motor for this pump is the diaphragm. After injury the movement of the diaphragm increases. It goes deeper into the abdomen to suck air in. (You can see the abdomen expand.) And it rises further upward into the chest cavity to push air out.

To examine a victim: See p. 44.

Is he able to get enough oxygen into the blood?

Talk to him. If he talks back and his words make sense, his brain is working well. This means that at the moment he has enough oxygen in the blood. But it is possible that the oxygen in his blood is slowly decreasing. So keep on talking with him while you examine him and talk to him all the way to the hospital.

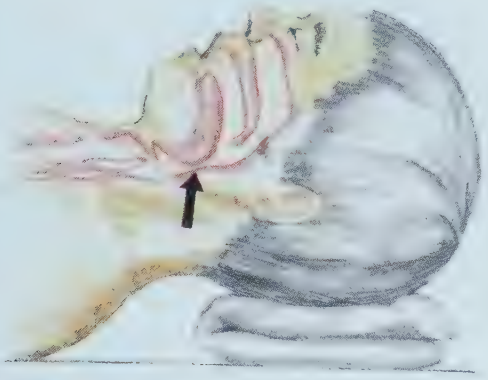
The signs of too little oxygen in the blood: Breathing is rapid, more than 30 breaths each minute (adults). The victim is pale, sweating, and restless. As the supply of oxygen in the blood gets lower and lower, he becomes confused, says crazy things, pushes you away, or pulls out the IV lines. He is in danger! You have to find out how to get more oxygen into the blood now:



Is the airway open?

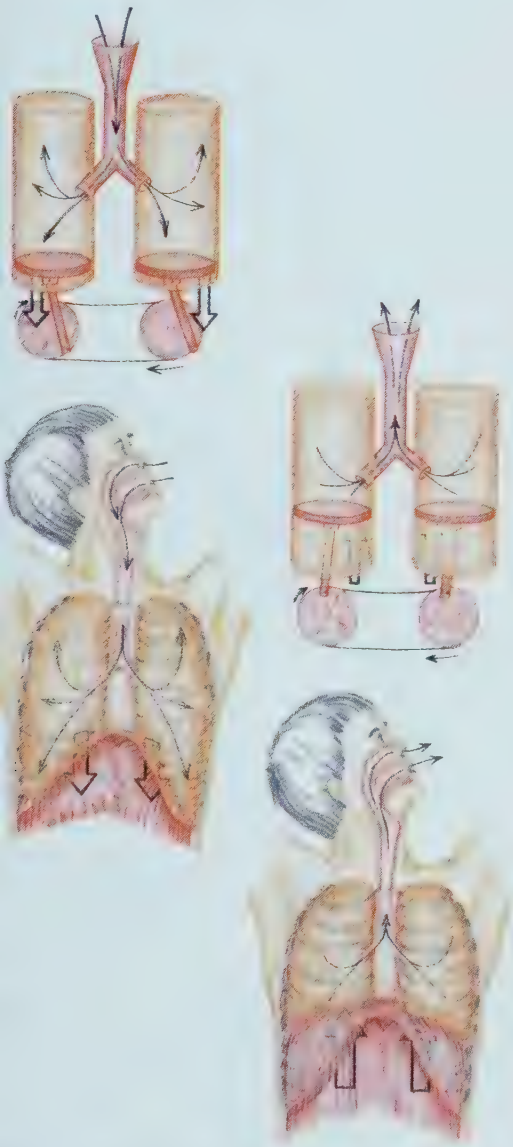
1. Is the airway open? If not, do something! If it is open, carry on with step 2.
2. Is the breathing good? If not, do something! If it is good, carry on with step 3: Stop the bleeding, give IV infusions.

Blood loss: See p. 30.



Tongue blocks airway in unconscious victim.

Head tilt – chin lift opens the airway.



The lung "suction pump".

Is the airway open?

With complete airway block the victim is dead within 5 minutes.

1. If the victim talks to you with a normal voice, his airway is OK.
2. **Tongue block.** If his voice is strange, his breathing is noisy, or he does not talk back, tilt his head by the chin and place your ear to his mouth. If you cannot hear or feel his warm breaths in your ear, he is dead or dying: Start CPR now! If the breathing sounds became clearer when you tilted his head, it means he had a tongue block in the throat. You removed the block by tilting the head. Excellent! Keep his head tilted.
3. **Airway block.** If the breathing sounds are still noisy with the head tilted, there may be something inside his airway. Remove it by sweeping your finger inside the mouth to clear it. Then suck out mucus, vomit, blood, and dirt from the airway if you have a suction apparatus.
4. **Prevent airway block.** It is good if he had a gag reflex or coughed when you sucked the airway. If he did not gag or cough, he may be unconscious. Place all unconscious victims in the recovery position.

More on airway life support: See p. 46.

CPR: See p. 68.

Positioning: See p. 58.

Is he breathing well?

Less than 25 breaths each minute, and his breaths are deep: You can see the belly expand when he sucks air in. This means that the lungs are working well, and the reason for low blood oxygen is probably blood loss.

30 breaths or more each minute, but panting like a dog with shallow breaths. There can be four reasons for this:

1. Pain makes the breathing shallow. Give IV ketamine for pain relief and see if the breathing gets slower and deeper.
2. The lung pump is damaged because he has a chest injury. The chest wall muscles contract in convulsions, the chest cage becomes "stiff" – and the breathing is shallow. Give IV ketamine for pain relief. If the breathing is still poor, he probably needs a chest tube drain.
3. The lung pump is locked because he has injuries to the abdomen. Fluid and gas have inflated the stomach and "locked" the diaphragm. Let him sit or half-sit. Put in a stomach tube to deflate the stomach.
4. The diaphragm is not working any more: If the blood oxygen is very low, the diaphragm becomes soft. The victim is breathing only by lifting his chest. For each breath in you can see the belly move in, for each breath out the belly expands. This is the opposite of normal breathing movements! Hollowing out of the upper part of the belly for in-breaths is a sign of very low blood oxygen. The victim is close to dying. Be ready to start CPR.

Pain-killing: See p. 60.

Chest tube drain: See p. 90-93.

Stomach tube: See p. 49.

The oxygen supply system can only work if all three parts work

If the airway is OK and his breathing is OK, but he is getting worse, the victim is probably losing blood.
If the airway is OK and the heart rate is OK (less than 100 beats each minute), but he is getting worse, the victim has a breathing problem.

Life support: Blood circulation

If a lot of blood is lost, the blood pressure falls even if the pump works as hard as it can.

Cover him! Uncovered victims become cold and bleed more.

Khmer medics train in packing of fragment wounds on a dummy.

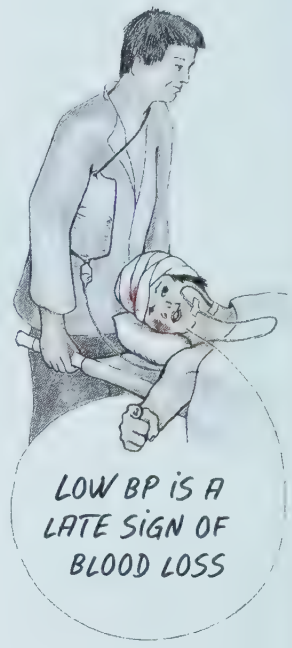
First stop the bleeding!
Then replace the amount of blood already lost!

More on stopping the bleeding and volume treatment: p. 50-57.

The body has three lines of defense against blood loss

The first line of defense – the body tries to stop the bleeding: Immediately after injury, nerve signals make the arteries around the wound contract. This reduces the blood flow and reduces blood loss. Platelets form blood clots to plug the tears in the blood vessels.

The second line of defense – the heart works harder: If the first line of defense is not good enough and blood continues to be lost, the heart works harder. The heart responds by beating faster so that it can speed up the blood flow: There are only a few red blood cells to carry oxygen but they flow through the body faster!



The third line of defense – shutting down blood flow to limbs and skin: If even more blood is lost, the arteries to the skin and the limbs contract. The skin and the limbs become cool – their share of the blood supply is delivered to the important organs. This is an emergency measure for the body – it "sacrifices" the limbs to save the life.

If all lines of defense are broken – the blood pressure starts to fall: This is a dangerous sign. Around 1/3 of the total blood volume has been lost – more than 1.5 liters in an adult. Even if the heart works as hard as it can, it is difficult to get enough blood supply to the brain and other main organs.

Help the body stop the bleeding – keep the patient warm

Even in tropical areas, mine victims become cold. Losing warm blood, having big wounds, wearing wet clothes, being carried in open pick-up cars, and surgical operations all make the body and the blood cold. Also beware of IV infusions: Even IV infusions at "room temperature" (20° C) makes the blood become cold. Cold blood platelets are "lazy". Below 32° C they do not work at all.

Give IV infusions at 40° C.

Help the platelets – pack the wound from outside

Your friends, the platelets, work from the inside. They try to pack the wounds in the blood vessels with blood clots. This is how you can help them:

- Lift the bleeding limb and squeeze the artery to the injured limb with your hand. This reduces the speed of the blood flow, making it easier for the blood clot to stick to the wound.
- Pack the wound with gauze or cloth. Once you have placed a pack from outside onto the bleeding vessels, the platelets packing the wound from the inside have something to "lean on".

See drawings at p. 50.

When the bleeding is stopped, give warm IV infusion.

Running is useless. Stop and do something!

Temporary repair in the field.

Permanent repair at the hospital.

- Apply a tight dressing with elastic bandages on the injured limb. The pressure from the dressing keeps the limb blood flow low and prevents blood clots from being "washed out".

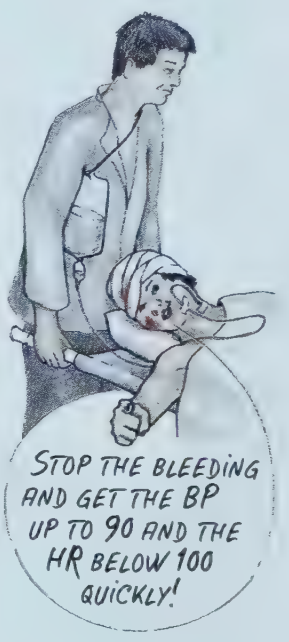
How much blood has he lost?

Like Ahmed, the victim may be bleeding inside. This is how you can find out: Talk to the victim. Feel the temperature of his limbs with your hand (and compare to your own skin). Count his heart rate. Read his systolic blood pressure.

1. Everything seems "normal": He may still have lost some blood. A healthy adult may lose 1 liter of blood, and the only response will be a slight rise of the heart rate. Action: Examine again after 30 minutes. If the signs are still normal, he is not bleeding a lot.
2. He is confused. The limbs are cool. Heart rate is more than 100 beats per minute. Blood pressure is still normal: He has lost much blood. His brain lacks oxygen. If he continues to bleed the defenses will break and the blood pressure will fall! Action: Stop the bleeding if you can! Then give 2 L of warm Ringer solution by two IV drips and see how he responds.
3. He is very confused or unconscious. Heart rate more than 100 beats per minute. Blood pressure is less than 90 mm Hg: The blood loss is critical! He has too little blood to provide the main organs with the oxygen they need. There is immediate risk of heart failure, brain damage and death. Action: Give 2 L of warm Ringer solution by two IV drips rapidly and see how he responds.

Ahmed's story: See p. 2 and 18.

Children are different from adults: See p. 72.



The most dangerous sign of bleeding inside: He does not respond to IV infusions

You have stopped the bleeding from the limb wounds. The victim has got 2 L of warm IV infusion. Now study the response:

- If the blood pressure rises to 90 mm Hg or more, and the heart rate is down to 100/ per minute, and they stay there, he is not bleeding much on the inside.
- If the blood pressure and heart rate do not respond, or they improve only for a short time: There is a lot of bleeding inside! Get that victim to an advanced medic or surgeon as soon as possible.

Chest bleeding: See p. 90 and 122.
Abdominal bleeding: See p. 94 and 118.

Why stop the bleeding first? Why not start with the IV infusions?

Answer: If you increase the blood flow and the blood pressure before the bleeding is safely stopped, the blood clots will be washed away. The wound will start bleeding again.

Some doctors say we lose time by stopping the bleeding and giving IV infusions in the field. They say we should simply rush the patients to the hospital. Are they right?

Answer: They are wrong. They think in terms of Western rescue systems and helicopter ambulances. They don't know how far you are from the hospital. But they know – and now you do – that the longer the victim is starving for oxygen, the greater the damage to his body.

Ban the tourniquet!

Tourniquets don't work.

We have seen hundreds of mine and war victims with severe limb injuries. They arrive at our clinics nearly dead from bloodloss with tourniquets placed by a relative or health worker in the field. We have also seen those who survived looking with sadness at the short arm or thigh stumps left after surgery. They ask: *Why did they have to cut off so much of my leg? The mine wound was down here at my foot!*

We have looked at standard books on emergency medicine and found that they recommend tourniquets to stop bleeding from limb injuries. We have seen the tourniquet recommended in ICRC and UN posters. But they are all wrong:

- Tourniquets don't work, they don't stop the bleeding.
- Tourniquets are dangerous, they are limb killers.
- There are better ways to stop the bleeding with less side-effects.

Inappropriate surgery: See p. 26.

The problem in limb injuries: A dying victim with a dying limb

The victim is dying from oxygen starvation because of blood loss. We need to stop the bleeding to save his life.

The limb is dying from oxygen starvation because it does not get enough blood: At the wound, blood vessels are torn by fragments or the blast wave. Above the wound, arteries are destroyed by the blast wave. The swelling of "the hidden wound" traps muscles and collapses more blood vessels. To save as much as possible of the limb, stop the bleeding and get as much blood into the limb as possible.

The "hidden" wound in blast mine victims: See p. 27 and 100.

Lift, press, pack, and bandage. Village training in Cambodia.

There are two ways to do this. Let us compare them

1. **Packing and warming:** Lift the limb. Press your hand on the main artery to the limb. Pack gauze or cloth into the wound. Put a tight dressing on the entire limb. Keep the patient warm.
   The aim of packing and warming is to reduce the blood flow in the injured limb. Pressure on the artery and pressure from the tight dressing make the blood run slower so that clots can form at the bleeding points.
2. **Tourniquet:** A rope, leather belt or strip of cloth is tied around the limb and tightened as much as possible.
   The aim of the tourniquet is to stop blood flow to the injured limb. The theory is that if the tourniquet is tied tight enough, it will block all blood vessels to the limb, both veins and arteries. It will not bleed, but the limb is shut off from the oxygen supply system.

For details: See p. 50 and 51.

Bone marrow bleeding despite tourniquet.

The tourniquet doesn't work: Bone marrow bleeding

The tourniquet cannot shut off the bloodstream inside the bone marrow. If it takes 6 hours to reach the hospital, lots of blood will be lost. However, if you pack gauze into compound fractures and bone amputations, and keep the patient warm, bleeding from the bone marrow will stop.

The tourniquet does not work: The arteries are hidden

The three main arteries below the knee are hidden between the bones (the tibia and fibula). Even the tightest tourniquet cannot block them. Below the elbow, the three main arteries are also hidden between the bones (the radius and ulna). So the tourniquet cannot work here either. Hence, in all injuries to the leg, and even injuries to the foot, the tourniquet must be placed at the thigh. In injuries to the arm, it must be placed above the elbow.

Study the anatomy: P. 209 and 210.

Note his swollen and bluish hand. The tourniquet is blocking the veins only.

The tourniquet doesn't work: It increases bleeding

Strong adults have a lot of muscles in their thighs and arms, and the main arteries lie deep inside the muscles. A tourniquet made of rope cannot be tied tight enough to squeeze these deep arteries. However, the veins have thin walls and the tourniquet will block the veins. So the arteries which are still partially open pump blood into the injured limb, but the blocked veins cannot drain the blood – and bleeding increases.

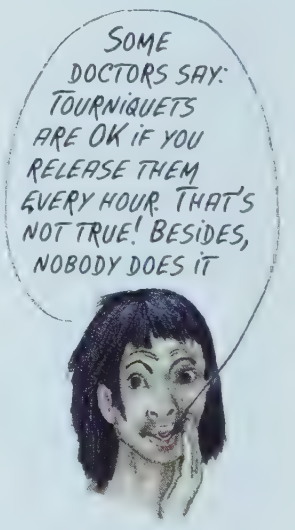
When the blood pressure has come down to below 90 mm Hg, the body naturally shunts blood away from the limbs. This is when the tourniquet may reduce bleeding. But it is too late! And what happens when you give IV infusions and take the blood pressure up towards normal? The limb starts bleeding again, despite the tourniquet.

The tourniquet is dangerous: Trapping of muscle

The end-point after 7 days with the tourniquet on. See Antonio's story on p. 134.

Trapped muscle in the amputation stump is a common reason for wound infections, and for cutting off too much of a limb. The trapping is caused by the swelling of muscle damaged by the mine blast wave. Entrapment is common in the muscles of the lower leg and forearm. Tourniquets, blocking the venous drainage from the hidden wound, promote swelling and speed up trapping of muscle. Using tourniquets is asking for entrapment problems.

Muscle entrapment and fasciotomy: See p.100-103.



The tourniquet is dangerous: It injures blood vessels

If the victim has had a tight tourniquet for more than 2 hours and you remove it, a disaster happens in the limb: Small arteries and veins become blocked due to a bodily response called re-perfusion damage which is well known by most surgeons. The longer the victim had the tourniquet on, the more the blood vessels become damaged when the tourniquet is removed.

Stop bleeding – in brief

All limb bleeding can be stopped if you lift, press, pack, and put on compressive dressing.
Always keep victims warm.
Tourniquets kill limbs, increase bleeding, and only work when the body has lost a lot of blood. That is too late.

Prevent infection – support the body's defenses

What are bacteria?

Mine wounds are dirty and contain millions of bacteria from the time of injury.

Bacteria are one-celled organisms. They are everywhere, in the soil, in the air, and inside our body. Most bacteria are "friendly" and useful. Bacteria in the ground produce soil from dead animals and plants. The bacteria in our gut produce vitamins and help us digest food. Bacteria need food to live and multiply. The bacteria causing problems in mine victims feed on human tissue. If for example the gut is injured by mine fragments and the bacteria spread outside the gut, they turn very "nasty". They start feeding on blood and dead cells. They get into damaged belly organs and make a poison that kills healthy cells and then eat these cells. Bacteria multiply rapidly as long as they have enough to feed on. Millions of bacteria can be created in a short time.

What is infection?

The presence of bacteria does not mean infection. There is infection when

- bacteria invade tissue or organs where they don't belong
- and they find enough food to multiply rapidly
- and they destroy the tissues around them.

Bacteria can also cause infection by spreading poison through the bloodstream that can destroy remote body organs.

Note: Infection is not a diagnosis you make in the laboratory or with a microscope by counting bacteria. Only you can decide whether there is an infection or not. You can do this by examining the victim and looking for signs of infection:

- **Local signs:** The wound is red, warm, swollen, and painful. It may smell bad or you may see pus coming from the wound.
- **General signs:** Fever and increased heart rate.

See photo on p. 33.

Tourniquets block the oxygen supply, and cause wound infection.

Defenses against infection

Starve "nasty" bacteria

Dead and damaged cells are food for nasty bacteria. Prevent more cells from dying. **Get enough oxygen into the blood:**

- Keep airways open.
- Give pain relief (IV ketamine) early and throughout the transport to hospital. Pain causes poor breathing.
- Stop the bleeding as soon as possible. Blood loss causes oxygen starvation in the limb.
- Pack deep wound tracks carefully with gauze or cloth. In that way you prevent blood from collecting inside the wound tracks. Bacteria feed on these blood collections.
- Never use tourniquets – they increase cell death.
- When the bleeding has stopped, get the blood pressure up to a minimum of 90 mm Hg as soon as possible. The longer the interval of oxygen starvation, the more dead cells there are for the bacteria to feed on.

Why not tourniquets? See p. 32 and 50.

Remove "alien" bacteria

Blood contains white blood cells that eat unfriendly bacteria. It also contains some proteins that help remove bacterial poisons. This defense does not work unless blood can reach the injured area. For field life support this means taking these steps:

- Stop the bleeding. The longer it bleeds the more white blood cells are lost.
- Support blood circulation to the injured area by getting blood pressure up to a minimum of 90 mm Hg as soon as possible after injury.
- Keep the victim warm. We fight infections best at body temperatures around 38° C.

Starvation weakens the body and increases risk of infection. Starving Afghans during the anti-Soviet war 1986.

Protect the "headquarters"

From the gut mucosa, chemical signals are sent through the bloodstream to start and direct the body's defense systems. The gut mucosa acts like a sort of "headquarters". The gut mucosa needs nutrition to work and it gets this nutrition in two ways:

1. From the blood. The gut mucosa takes oxygen and nutrients from the blood. If a lot of blood is lost, the blood supply to the gut slows down and the "headquarters" cannot work properly. The sooner you restore good blood circulation after injury, the less damage there is to the gut mucosa.
2. From the gut content. The gut takes half of the oxygen and nutrition it needs from the gut content. If the victim's gut is empty, the gut mucosa will suffer. If the transport to the hospital takes more than 12 hours, the victim needs high-energy feeding along the way.

How to prepare high-energy soups: See p. 66 and 162.

What else can you do?

Wash the wounds and leave them open. Remove dirt and wash the wounds with large quantities of soap and boiled water. But if the wound bleeds a lot, forget the dirt and washing – it is more important to stop the bleeding. Leave all wounds open – never suture them.

Disinfection in the field: See p. 106.

Do not introduce unfriendly bacteria yourself: Work with clean hands and clean instruments where you have to.

Surgery within 8 hours: The surgeon removes the blood that has collected and cuts away all damaged tissue to remove what the bacteria feed on. Such surgical cleansing is best done within 8 hours of the injury.

Antibiotics: Give one large dose of antibiotics soon after the injury. But note:

- Antibiotics do not stop ongoing wound infection.
- Antibiotics do not work at all unless the blood circulation is good enough for them to reach the injured area.

Preventing infections – in brief

The best prevention is done in the field: Make the time of oxygen starvation after an injury as short as possible!
Get to the hospital: Surgical cleansing is best done within 8 hours.

Sum up: Early life support is good life support

Let us look at Ahmed's story again (see p. 2 and 18)

Severity Score

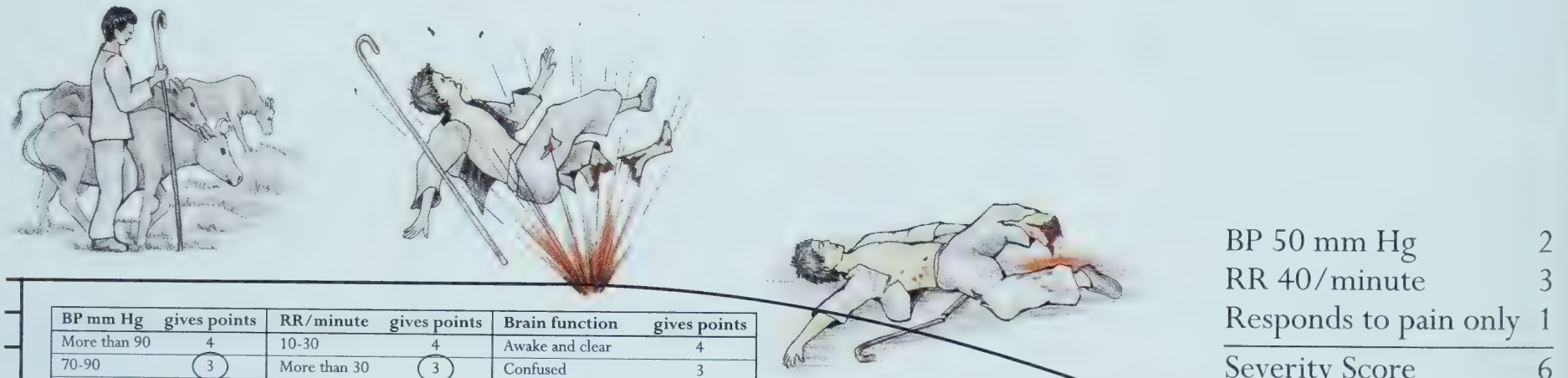
BP 120 mm Hg	4
RR 20/minute	4
Awake	4
Severity Score	12

BP 80 mm Hg	3
RR 35/minute	3
Responds to sound	2
Severity Score	8

Early life support by villagers.

12 = normal 0 = death

Without village first helpers – what had happened then?



BP mm Hg	gives points	RR/minute	gives points	Brain function	gives points
More than 90	4	10-30	4	Awake and clear	4
70-90	(3)	More than 30	(3)	Confused	3
50-70	2	5-10	2	Responds to sound	(2)
Below 50	1	1-5	1	Responds to pain only	1
Heart arrest	0	No breathing	0	No response	0

Severity Score

BP 120 mm Hg	4
RR 20/minute	4
Awake	4
Severity Score	12

BP 80 mm Hg	3
RR 35/minute	3
Responds to sound	2
Severity Score	8

BP 50 mm Hg	2
RR 40/minute	3
Responds to pain only	1
Severity Score	6

Ahmed is dying – no villagers came.

12 = normal 0 = death

You need a simple and exact way to determine the victim's condition: Is he getting worse – or is he improving? **The Severity Score** is the sum of three important signs: The blood pressure (BP) **plus** the breathing rate (RR) **plus** the consciousness (brain function). **See more on p. 80.**

BP mm Hg	gives points	RR/minute	gives points	Brain function	gives points
More than 90	4	10-30	4	Awake and clear	4
70-90	3	More than 30	3	Confused	3
50-70	2	5-10	2	Responds to sound	2
Below 50	1	1-5	1	Responds to pain only	1
Heart arrest	0	No breathing	0	No response	0

BP 100 mm Hg	4
RR 35/minute	3
Confused	3
Severity Score	10

But Ahmed's abdomen is still bleeding.

BP 70 mm Hg	3
RR 35/minute	3
Responds to sound	2
Severity Score	8

Only surgery could stop the bleeding.

BP 110 mm Hg	4
RR 25/minute	4
Awake	4
Severity Score	12

Medic Ibrahim arrived two hours after the injury.
But if you are late, even advanced life support is in vain.

Heart arrest	0
No breathing	0
No response	0
Severity Score	0

Let us sum up so far:

Good life support means making the period of oxygen starvation as short as possible.
That is: To save lives, early and simple life support is the most important step. And that can be done by any villager – if you train him.

The rest of this book is on how you can learn to do life support yourself – and teach others.

Points to note – Section 2

The simple things are most important
Section 2 is about simple life support. On p. 40 to p. 80 the basic, simple measures of life support are discussed in detail. Many of the wounded die before they reach the hospitals, or during hospital treatment. It is a sad fact that many of those deaths could have been avoided – if the wounded had been given proper life support. In most cases, proper life support is not a question of complicated medical treatment, modern ambulances, and high-tech equipment. It's a question of very simple things that you can do with your bare hands – such as keeping the airway open, and preventing it from being blocked by vomit during the transport. If you do not manage to do that, it is no use learning advanced life support like endotracheal intubation.

Nothing is simple unless you have learned to do it
Practical things can only be learned by actually doing them, not just by reading about them in books. So it is with life support. When you study Section 2, you will find small notes in the right margin ("transport of face-injured victims: see p. 46"). Follow those notes: they take you to other parts of the book where you can find more information on the same problem. The notes also take you to parts of the book with case reports on how life support is done in real life.

Yellow text = Warning! This is advanced life support!
Life-support measures discussed in Section 3 can save lives. But they can also be harmful, even deadly, if done the wrong way. You need a lot of hands-on experience in giving simple life support to the wounded before you can start to learn more complicated methods. That's why we call the contents of Section 3: advanced life support.

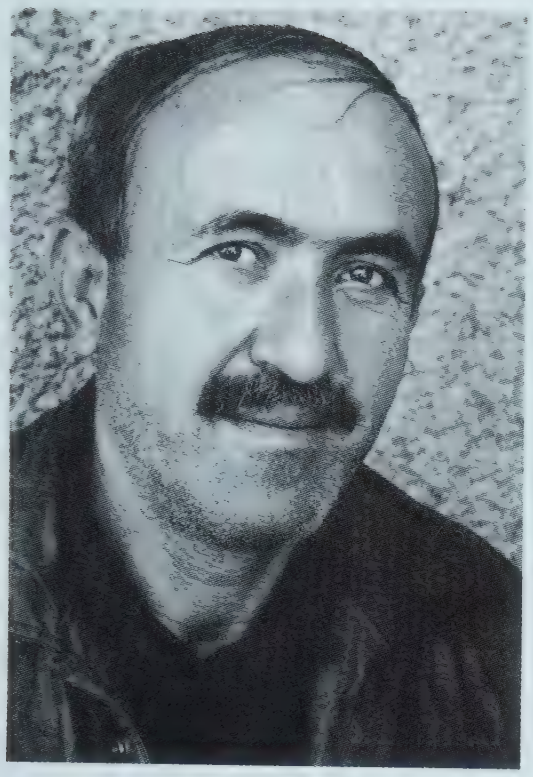
Section 2:
Simple life support

Prepare yourself. Work together

As a medic you must be prepared to help at all times! Maybe you are working in the fields when somebody cries for you: *Help! There's a mine accident in the forests!* Or you are sleeping peacefully at night with your family when some soldiers get drunk and play the fool with their guns. All of a sudden you have to be ready for action. You have to prepare yourself to act efficiently. You are going to see bad wounds, the injured in severe pain, and terrified families. Disturbed villagers will be shouting at you. Unless you and your equipment are well prepared, you cannot do the job.

See case story p. 124.

I am calm and strong



Calm and strong. Faeq is an experienced Kurdish mine medic.

It's OK to be nervous: Even experienced doctors are nervous and feel the pressure when called to an accident. That's normal. That pressure makes us do our very best! But the pressure you feel has to be controlled.

Ways to control your nerves

- ***I have done well before, I am good!*** On your way to the scene of injury, recall previous accidents where you did well. Decide to repeat now what you did well at those accidents.
- ***I am well trained, I can manage this!*** Recall all the training you have done. You know how to do these things: First the airway, the breathing, and then the blood circulation. Basic life support is not difficult, if you do not forget to do the important, simple things.
- **Imagine what the scene of accident will look like:** There will be crying and shouting. There may be several victims. It may be dangerous as they may be lying inside the minefield.
- **Find out how to start:** When you get to the place of the accident, tell everybody: *I am here, I am a mine medic – now listen to me!* Then you start gathering information: How many are injured? Where are they? Can we get at them, or are there mines around?
- **Tell yourself again and again:** I am calm and strong.

Work together

In all accidents there are many problems to solve. You can't solve them all alone:

- **Gather a few helpers around you.** Ask if there are people who are trained first helpers or who assisted at mine accidents before.
- **If you are alone, call for helpers.** Shout *help!* Fire a gun, light your torch, or light a fire.

Five rules for working in a group

1. **There must be one group leader.** If you are the best qualified at the scene, you have to take on that responsibility. Speak out: *I am the leader now, follow me!*
2. **Gather information – find out what is the main problem.** First, is the area safe, can we get to the victim safely? Then, if there are more victims, which victim needs to be helped first? Next, what is that victim's

Group work: See case stories p. 160.

Work together! Encourage each other! A front-line clinic in Afghanistan, 1990.

3. **Give clear orders.** When you have found out the main problem, you, as the group leader, should tell the group members what to do.
4. **Group members, report to the leader!** Tell the group leader at once if any of you are having any difficulties. Also report to the leader when one job is finished.
5. **Talk together. Discuss. Encourage each other.** Discuss difficult decisions together. Remember that the others are also nervous. Tell each other: *We'll manage this.*

Helpers should be well organized in working together at an accident site. In working as a group, they can solve problems one after another in a systematic way. As a result the group becomes more confident of themselves. So you and other helpers in the group should get together to sum up all your experiences when the job is done. Then all of you will be better prepared for the next accident.

Also take care of yourself: See p. 82.

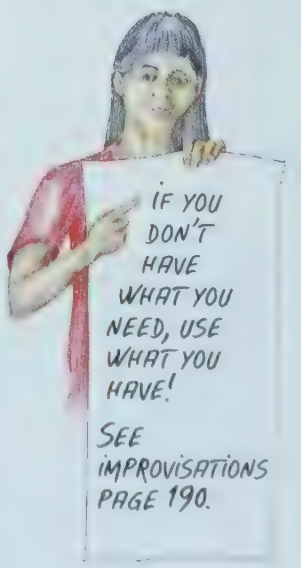
Prepare the equipment

Like a carpenter, the mine medic needs certain tools to do the job. Your equipment must always be well packed, maintained, and clean because you may need it at any time. And when that time comes, you will need it in a hurry. There will be no time to dig through messy bags and boxes to find your tools.

Essential equipment for basic life support

- **For the airway:** Suction apparatus and suction catheters.
- **For the breathing:** Stomach tubes.
- **To stop bleeding:** Pads of gauze or cotton cloth. Minimum 5 rolls of elastic bandages, 10 or 15 cm wide.
- **To replace blood loss:** IV catheters. Infusion sets. 5 liters IV electrolyte infusion. Adhesive tape.
- **To keep victims warm:** Empty plastic bottles to fill with warm water. Blanket (wool) or sleeping bag. In the rainy season: Plastic sheet.
- **IV drugs:** Ketamine. Antibiotics. Adrenaline. Syringes 5 mL. Cannulas 0.8 x 40 mm.
- **Others:** Headlight or other strong torch. Spare batteries. Scissors. Sharp knife. Sheet of plastic or canvas. Injury Charts and pencil.

More on medical kits: See p. 140 and 164.



Store the equipment watertight and dry in a backpack or shoulder bag. You need to have your hands free during the transport of victims.

Prepare yourself – in brief

Be calm and strong. Prepare yourself in order to control your nerves before you enter the site of injury.
Work together! Know the five rules for working in a group.
Always have your equipment packed and ready to go.

Danger! The victim is inside a minefield

Land mines occupy fertile land. Farmers and their families are the targets.

When one mine fires, there are more mines around

Most mines are placed in pairs, series, or clusters. Single mines are seldom found – so there may be unexploded mines around or under the victim. If the victim cannot get out of the unsafe area by himself due to injuries – how can you rescue him and protect yourself from death and injury at the same time?

Don't rush at the victim

The first person to get to the site of injury must take charge and stop anyone from rushing in to help. Put someone in charge especially of children to make sure they don't get in the way. Also let someone look after members of the victim's family so that they don't obstruct the rescue. Call to the victim: *Stay still and calm! We are coming to rescue you!*

How often do people use this land? Ask farmers, shepherds, or nomads.

Ask yourself some questions

Stop for a moment and think. These are the crucial questions:

How often do people use this land?

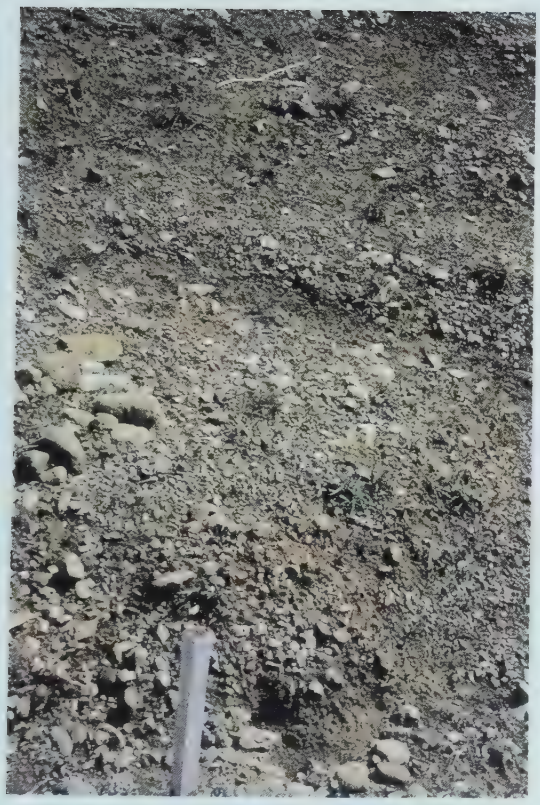
Have other people been blown up close by?

- If the land is not in regular use, and other people have been injured on it, then the situation is very serious. There are probably other mines near the victim.
- If the land is used often and no one else has been blown up, then the situation is probably less dangerous.

Plan the rescue

If there is a mine-clearing team nearby, send for them quickly. If not:

- **Find a safe place.** Find a place closest to the victim which you know is safe. It may be a road or path in common use. Or you may jump from one big stone to another to get to the victim.
- **How many helpers do you need?** If it is a child victim then one adult will be enough. As a rule the least number of persons possible should be allowed to enter the risk area.
- **Send for equipment and helpers:** A long strong knife, a long piece of rope, and a long soft wooden stick. If you need a stretcher to be made, send somebody to do that immediately.



Blast mines are hard to see. In this photo there are two PMN mines, can you see them?

Entering the minefield

Observe the victim

- If he has an amputation with few fragment wounds, he probably stepped on a blast mine. There may be other blast mines around – you have to probe the ground (see below).
- If he has several fragment wounds and no amputations, he is probably injured by a fragmentation mine. Watch out for tripwires when you move towards the victim.

Types of blast mines: See p. 24.
Types of fragmentation mines: See p. 20.

Observe the ground

- Dry solid ground: Blast mines are hard to see on dry solid ground even if they are not covered by soil. You have to probe a route to the victim.
- Wet ground and paddy fields: Probe along, following the victim's footprints. Note that most modern blast mines work underwater.

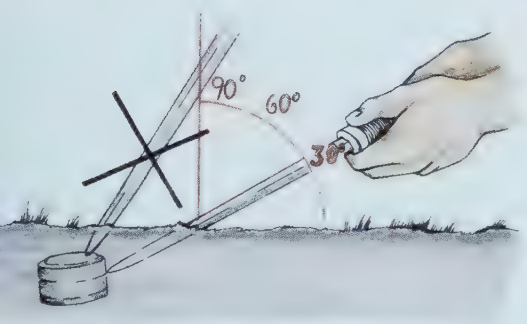
- Grasslands or forest: Probe carefully for tripwires ahead of you by using a long and soft wooden stick. Then probe the ground.

Probing a safe route to the victim

When you probe the ground, sit close to the ground to make yourself a small target.

Probing takes time and patience. You and your friends of the rescue group may become impatient. But you must realize that there is no other way to be sure of your safety.
How careful you are depends on you.

30° obliquely, 10 cm down, 1 meter wide: One of the rescue group should take the long knife and begin to quickly but carefully probe the ground with the knife at an angle of 30° to a depth of 10 cm. Probe along a width of 1 meter, piercing the ground every few centimeters.



Always probe at an angle of 30° towards a mine. Or else you risk pressing down on the mine and releasing it.

Mark the safe route: Probing forward, one helper should carefully mark the borders of the safe route by scraping a line in the earth or placing a rope.

If the knife strikes anything hard: Carefully scrape away the earth until you can see it. Be careful not to press down on the object. If it is a stone or a harmless object, carry on probing.

If you encounter a mine or something suspicious: Don't try to remove it! Mark the spot carefully. Then move to one side of the mine and carry on probing the ground towards the victim.

Get the victim out before you start life support

Probe around and under the victim so that there is room to stand when lifting him.

Carry the victim to a safe place using exactly the route that has been probed. If it is a long way or the victim is heavy, you should stop to rest as often as necessary.

The mine medic should not enter a minefield

It is a risky job to rescue a victim from inside a minefield. Somebody has to do it – but it should not be the mine medic himself! If the mine medic steps on a mine, years of training, knowledge and essential medical equipment are blown up. Then everybody – including the actual mine victim – will suffer.

Our duty is saving lives – not to prove our courage!

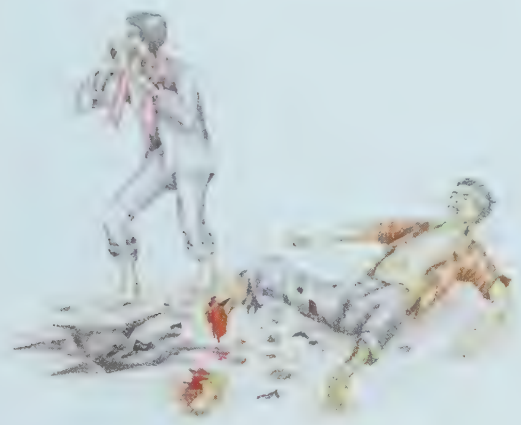
The victim is inside a minefield – in brief

If there are mine-clearance teams nearby, send for them quickly. These mine clearers can carry out the rescue safely and quickly. If not, you stand a good chance of success if you remember this:

- Organize and control everyone involved in the rescue. Keep the others clear of the area – especially children.
- Work quickly and carefully. Make sure that everyone involved knows the plan before you start.

How to examine a victim

Cartoons for village training made by a Cambodian artist.



Shout for help.

Get him to a safe place before you examine him.

Head tilt, chin lift! Is he breathing?

Clear out blood, vomit, and spit.

First examine the airway

Talk to the victim: If he can talk and cough, his airway is OK. Continue to talk to him and encourage him.
If he doesn't respond: Slap his face, tilt his head by lifting the chin, and put your ear to his mouth to check if he is breathing.
- Unconscious victim, no breathing: Start CPR immediately!
- Unconscious victim, breathing: Place in recovery position immediately!

CPR: See p. 68.
Positions: See p. 58.

Check the breathing sounds: Clear his mouth with your finger, and put your ear to his mouth.
- Snoring breathing sounds: Head tilt – chin lift immediately!
- Wet or bubbling breathing sounds: Head tilt and suction.
- Face injury with airway block: Intubation immediately!

See p. 86.

Do what is necessary to keep the airway open before you go on to examine the breathing.

Then examine the breathing

Observe the victim: Restless and confused victims are starved of oxygen. This can be due to breathing difficulties or blood loss:
- Place the victims in a half-sitting position unless they are unconscious.

Undress him to see the chest, and count the breathing rate (RR): Rapid breathing (RR more than 30/minute in adults) is an early sign of oxygen starvation.
- Place the victim in a half-sitting position if he is not unconscious.

Watch and listen to his breathing: Normally the belly expands when he breathes in and sinks when he breathes out. The breathing sounds are usually just as strong on both sides of the chest. Use stethoscope or put your ear to his chest:
- Rapid, shallow breathing may be due to pain: Give pain relief.
- No effect of pain relief, weak breathing sounds on one side: Place a chest tube immediately!
- Gasping breaths (the belly expands when he is breathing out) and very slow breathing (RR less than 10/minute) mean that the victim is close to dying: Be ready to give him CPR!

See p. 90.

If the airway is OK, **and** you have done what is necessary for any breathing problems – go on to examine the blood circulation.

Then examine the blood circulation

Stop the bleeding: If he is bleeding a lot from a wound, stop the bleeding before you examine the blood circulation.

Bleeding wounds? Let one helper compress the artery while you examine the airway and breathing.
See p. 50.

One hand counts the carotic pulse. The other hand lifts the chin and feels the victim's breathing.

Check the temperature of the skin, count the heart rate (HR), take the blood pressure (BP): Normally the skin on the legs and arms is warm, the HR lower than 100/minute, and the BP higher than 90 mm Hg.

- Everything is normal: He may still be bleeding inside and have lost 1 L of blood. Check again every 10 minutes.
- Cold limbs, HR more than 100/minute, BP still normal: He has lost a lot of blood. Give 2 L of warm Ringer solution IV. Check again after 10 minutes.
- Cold limbs, HR more than 100/minute, BP less than 100 mm Hg: He has lost too much blood. Give 2 L of warm Ringer solution IV as fast as possible and see how he responds.

More on volume treatment: See p. 54.

At this point register RR, BP, and brain function in the Injury Chart. Calculate the Severity Score before giving treatment.

Injury Charts: See p. 80.

Wash off the blood! Fragment wounds at the back. Can the abdomen be injured?

Then examine wounds and injuries

Take a weapon history: Which type of mine caused the injury – blast mine or fragmentation mine? How far was the victim from the explosion?

Undress the victim completely. Wash off dirt and blood. Examine the wounds.

- Can he move both arms and both legs? If not: There is injury to the spine. Handle with extreme care!
- Fragment wounds to the head, eyes, face, or neck: Risk of injury to the brain! Place him in the recovery position. Check brain function every 10 minutes.
- Fragment wounds at the back and between the legs: Risk of bleeding injuries in the chest or abdomen! Check RR, HR, and BP every 10 minutes.
- Blood at the opening of the urethra or in the rectum (explore the rectum with one gloved finger): It is bleeding inside the abdomen. Elevate arms and legs. Give warm IV infusions and check HR and BP every 10 minutes. Damage control laparotomy is urgent!

Transport of victims with spinal injury: See p. 59.

Yes, a small fragment can enter the abdomen also from behind.

Examine airway, breathing and circulation again

Wrap in warm clothes and repeat the examinations above. Register RR, HR, BP, and brain function. Calculate the Severity Score now and compare with the Severity Score before treatment.

See p. 36 again.

Under this wound is a severe injury to the intestines.

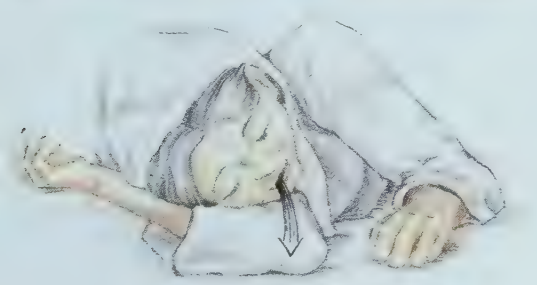
Severity Score improving: That's good. Check again every 10 minutes until you arrive at the hospital.

Severity Score not improving or falling: Danger! Re-examine the victim to find the reason or the main problem. Solve the main problem, then the victim will improve.

Open the airway

He should be in the recovery position

Carry victims with bleeding head injuries face down.



In unconscious victims contents of the stomach may block the airway. Recovery position prevents airway block.

Airway block kills. Cambodian farmer in the recovery position.

Vothy cuts a hole in the hammock

Medic Vothy was in the market buying sweet potatoes when he heard the explosion. As he came running to the site some children shouted: *Over there! Phat Dina pulled the wire hanging from the tree. Maybe he's dead.* The mine clearers just came. Vothy saw the green uniforms of two mine clearers behind the tree. *Is it safe to enter?* he cried. They waved him in.

Phat Dina was eight years old. He was lying on his back. His face was covered with blood and dirt, eyes closed and his white school shirt splattered with blood. Vothy knelt down beside the boy's head. *Phat Dina, can you hear me?* Vothy gently shook the little boy's shoulders. No reaction. Vothy gently tilted the boy's head backward and placed his ear close to the boy's mouth. He heard a bubbling sound. Vothy tore open Phat Dina's shirt and watched the chest. *Yes, it moves!* Vothy slid his finger down the side of the boy's neck to find the artery. *Strong pulse beats, at least one hundred! So, the main problem is a blocked airway.*

Vothy opened Phat Dina's mouth. He saw a pool of blood and wounds through the cheeks and in the tongue. *What shall I do? The bleeding in his mouth will drown him! And the suction apparatus is in my hut! What's in your backpack?* Vothy looked at the mine clearers. *Hammock, prodding knife and a carpet,* one of them whispered. *We must drain his mouth, face down, and get him to the village! Now hold his head tilted and get me your knife and the hammock!*

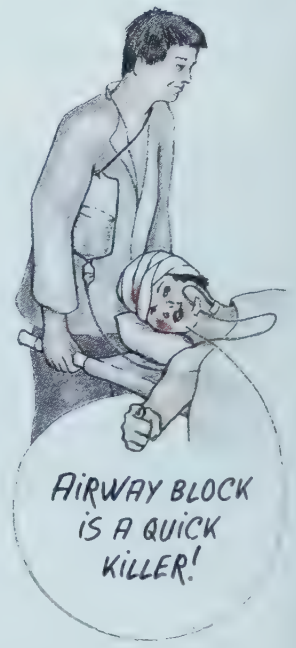
Vothy cut a hole at one end of the hammock. *Let's use the hammock as stretcher and carry him face down. Then the blood will run out of the mouth, and he can breathe freely.* They lifted Phat Dina gently on the hammock and placed his face over the hole, tied the hammock to a pole, and lifted it. Vothy squatted and looked under the hammock. Blood and saliva dripped from the boy's half-open mouth. *You can breathe freely now, my little friend,* Vothy said, relieved. *Just breathe!* He watched the boy's chest move up and down. The skin was not gray anymore, it had become pink. *Let's wrap the blanket around him. That'll keep him warm.* Vothy held one hand under the hammock. He could feel the warm breaths from the boy's nose. *Now quickly to the clinic!*

How an airway block kills

Oxygen starvation kills. A mine victim with a closed airway will die within minutes if he cannot get enough oxygen. It is useless to treat other injuries without first opening the victim's airway. Try to keep calm and stick to the basic rule: Immediately open the airway and find out if the victim is breathing!

The tongue will kill. The tongue is a large muscle in the mouth. If a mine victim is unconscious, the tongue will be flaccid and fall back into the mouth, blocking the airway.

Blood, vomit and mucus will kill. The strong reflexes that keep the airway free from food and vomit (cough reflex, swallow reflex, gag reflex) don't work in weak and unconscious patients. As a result, their airway becomes blocked, causing a quick death. This is a common and unnecessary cause of death in mine victims.



He is unconscious, the tongue is blocking the airway. Head tilt and chin lift opens the airway. Also see p. 72.

Find the cricoid ring. It's the first cartilage below the Adam's apple.

Cricoid pressure protects the airway.

To solve the problem: Remember 6 simple steps!

1. Tilt the head and lift the chin: Without moving the victim, immediately place your hand on his forehead and gently tilt his head backward. At the same time lift the chin with two fingertips placed under the victim's chin bone. Lifting the chin will move the tongue forward so that it does not block the airway.

2. Finger sweep, remove foreign bodies: When you have tilted the head back and lifted the chin, open the victim's mouth and look into it. You may need a torch. Remove fragments of teeth and pieces of bone with your fingers. Sweep the mouth clean with a piece of cloth.

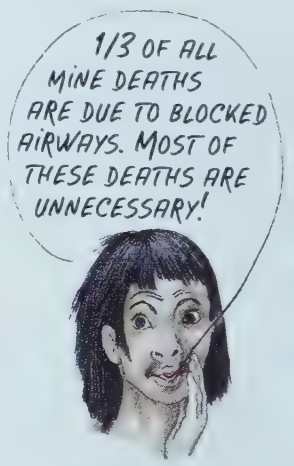
3. Not awake? Recovery position: A victim who doesn't talk or cough should be turned into the recovery position. This will prevent the tongue from falling back to block the airway. There is also less risk of vomit, blood and mucus running into the airway.

4. Face injuries? Face down! Blood from injuries to the face, mouth or neck, blood may block the airway. This may even happen in the recovery position. Place the victim with the face down, and the head tilted backwards. Make a hole in the stretcher or the mattress. Place the victim on it with his face over the hole to drain the blood.

5. Injured tongue? Pull it out of the mouth: When you pull out a bleeding tongue, the bleeding becomes less. Also the tongue will swell less – with less risk of a blocked airway during the evacuation. Get a good grip of the tongue between your fingers, using a piece of cloth. Pull it out of the mouth and downward. Use a safety pin, towel clamp or a suture through the tongue to fix it to the skin.

6. Cricoid pressure: If the victim is unconscious and for some reason cannot be in the recovery position but has to lie flat on the back – the stomach contents will easily float up into the mouth and leak down into the airway. The victim is drowning in his own vomit! To prevent this, press the cricoid cartilage firmly towards the spine to close off the eating tube (esophagus). But the airway is still open because of the solid structure of the cricoid cartilage. Be ready to use cricoid pressure during endotracheal intubation.

These are the simple methods to open the airway. Advanced methods: See p. 86-89.



Open the airway – in brief

If the victim can talk or cough, the airway is open.
If the victim is unconscious, the airway is likely to be blocked.

Always start life support by first opening the airway – you can examine the injuries later.

Use simple methods: A head tilt and chin lift opens the airway in most victims. The recovery position prevents airway block in most victims.

Support the breathing

You cannot know if his lungs are hit by this fragment. Support the breathing in all severe injuries – not in lung injuries only.

When the airway is open, your next task is to check the breathing. You must actively support the breathing in all severely injured persons, not only in those with chest injuries.

See drawing p. 29.

Victims lying flat on back breathe poorly. Place in a half-sitting position

Help the diaphragm move: The muscle plate called the diaphragm forms the floor of the chest cavity and the roof of the abdominal cavity. The diaphragm acts like a pump. As it moves up it presses air out of the lungs, and as it moves down, it sucks air into the lungs. The diaphragm is the most important muscle of breathing. For the breathing to be deep and efficient, the diaphragm must move 5 cm up and down. If an injured is placed on his back, the organs inside the abdominal cavity will press on the diaphragm and reduce its movements.

Positioning: See p. 58.

Half-sitting position in a pick-up car – for life support, monitoring, and comfort.

Breathing problem, victim awake – half-sitting position: Then the organs inside the abdominal cavity slip downward and the diaphragm can move freely. Sit behind the victim and let him lean against you. In this position you easily follow his breathing and check the neck pulse. At the same time you warm and comfort the victim.

Blood loss, victim awake – half-sitting, lift limbs: Place the victim in a 30° half-sitting position. When you lift the limbs, blood pours from the limbs into the central part of the body. That gives an extra 1 L of blood for the important organs.

Children are different: See p. 72.

Unconscious or vomiting victims – recovery position: The recovery position makes breathing less efficient, but it prevents blood and vomit from getting into the airway. It is more important to protect the airway.

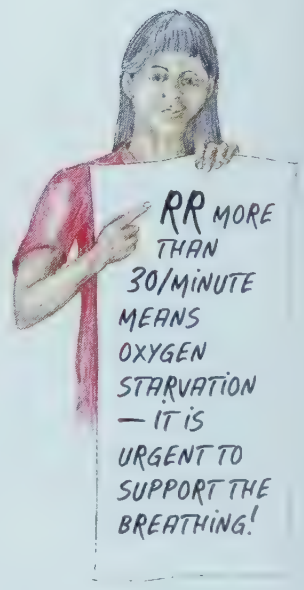
Patients in pain breathe poorly. Give pain relief

Count the breathing rate: Rapid, shallow breathing means that the victim is starving for oxygen. The normal rate of breathing in an adult is 10-30 breaths/minute. Then the breathing is deep and efficient. Pain and/or fear makes us breathe rapidly and superficially like a dog in the sun. This "dog-like" breathing is very inefficient, and is a warning sign that only small amounts of air are entering the lungs.

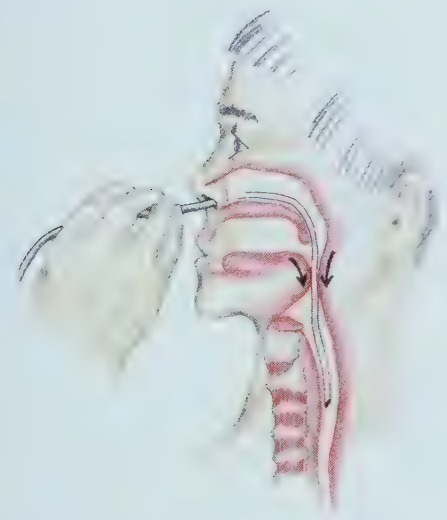
Place and carry the abdominal injured in a half-sitting position. Note how well the medic supports the airway.

IV ketamine pain relief is efficient: Unlike morphine and pentazocine, ketamine does not depress the breathing, and does not cause sickness and vomiting. Ketamine is the drug of choice for all victims in pain who have higher than normal breathing rates.

Patients in fear – give them your hand: Comfort, encouragement and a warm hand take away most fear. Especially in child patients who must not be left alone. Diazepam is not recommended because diazepam may depress the breathing.



Injury to the abdomen:
An inflated stomach blocks the lungs. Back-flow of stomach fluid may block the airway.



Introducing the stomach tube. Victim breathing well. When you see the tube in the throat – stop! Tell him to swallow as you push the tube downward.

Abdominal injuries. Place stomach tube

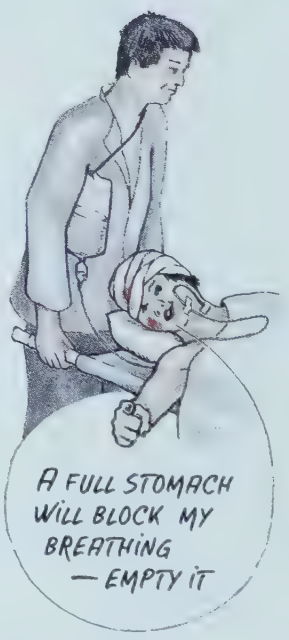
An inflated stomach locks the diaphragm: The intestines become paralyzed after injuries to the abdominal organs and severe injuries to the abdominal wall. Gases and fluid from the intestines leak backward into the stomach and the stomach swells up like a balloon. This balloon pushes on the diaphragm so that it can hardly move. Such inflation of the stomach happens within hours after the injury.

Study the anatomy: P. 211 and 212.

Place a stomach tube in all abdominal cases more than 3 hours from the hospital: The stomach tube empties the stomach, unlocks the diaphragm, and prevents vomit. The technique is simple – if you have trained for it.

- Equipment needed: Stomach tube, diameter 3-5 mm. A cup of water. Tape. Torch.
- Mark 60 cm from the tube end (use a marker pen or tape). In adults 60 cm is the distance from the nose down to the stomach. Place the conscious victim in a sitting or half-sitting position. Tell him what you are going to do. Place the unconscious victim in a side position so that vomit can easily be drained by the mouth.
- Moisten the tube with oil or water. Introduce the tube through one nostril along the floor of the nose. Tell the patient to breathe well – that helps him to avoid vomiting.
- Let him swallow repeatedly (he may take sips of water) while you forward the tube stepwise to the stomach.
- Check that the tube is not bent inside the esophagus: Blow air through the tube (by mouth). Press your ear to his stomach to listen – a bubbling sound over the stomach confirms that the tube is in the correct position.
- Fix the tube to the chin with tape.

Tube size and length: See table p. 165 and 189.



Problems?

- The victim coughs when the tube passes down the pharynx: This shows that the tube has entered the airway. Take out the tube and try again.
- Vomiting during the introduction indicates that you are too rough – calm the victim and yourself.
- In unconscious victims, vomiting is dangerous. Stop forcing the tube down if the victim vomits.

The tube is 60 cm down:
Checking the tube position.

Support the breathing – in brief

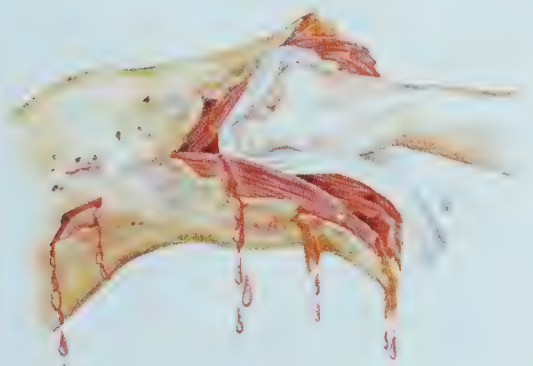
All victims severely injured and awake: Place them in half-sitting position.

Count the breathing rate: RR more than 30/minute (adults) – give IV ketamine pain relief.

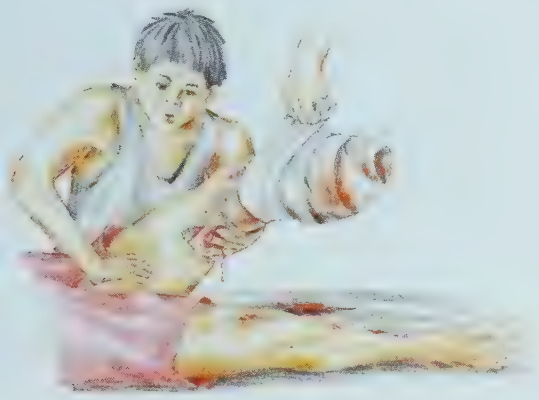
Calm the victim: Talk to him. Touch him.

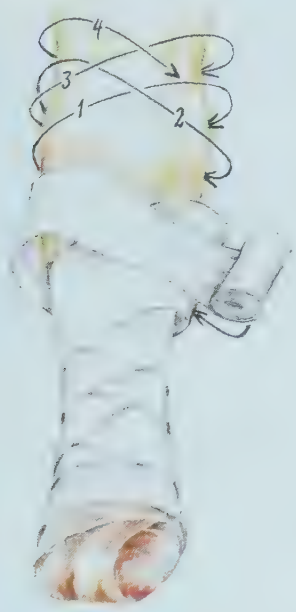
Place a stomach tube in all victims with abdominal injury if they are far from the hospital.

Despite two tourniquets, dark blood continues to drip from the wound.



Packing firmly deep inside the wound with any cloth at hand.





Train to apply pressure dressings firmly, accurately, in a criss-cross pattern.

Stop the bleeding

Have you done what is necessary for the victim's airway and the breathing? Then concentrate on the blood circulation.

Jalal is bleeding

Jalal, 8 years old, was herding his father's goats in the mountains. Running after a goat, he stepped on a small blast mine. His right foot was blown off and he fell unconscious. When he woke up, he found the other village boys around him. *We must stop the bleeding, and we must get medic Ibrahim!* His friend Rahim tried to stop the bleeding by tying his scarf around Jalal's leg as a tourniquet. But dark, almost black blood continued to drip from the wound. Jalal was weak now, crying silently. When Ibrahim arrived he praised the boys: *Good work, boys! But look how he is still bleeding. We have to compress the blood vessel in the groin. You can feel it under the skin. Then we will pack the amputation wound.* Ibrahim let Rahim press against the artery in the right groin. Another boy lifted the injured leg while Ibrahim packed the wound with a cotton cloth. Then he removed the tourniquet. *You see, tourniquets will not stop the blood flowing to the wound. They may even increase the bleeding. At the same time they cause the rest of the leg to die,* Ibrahim said. With four rolls of elastic bandage he made a tight dressing on Jalal's leg. They looked at the dressing – blood was not seeping through it. *Problem solved,* Ibrahim said. *Put your jackets around him. If he gets cold he may start bleeding again!* He counted Jalal's heart rate and measured the blood pressure. *He has lost a lot of blood. We must replace what he lost with fluid. I will place a cannula and give Jalal IV fluid and drugs. Then we can safely carry him to the village, and further to the hospital.*

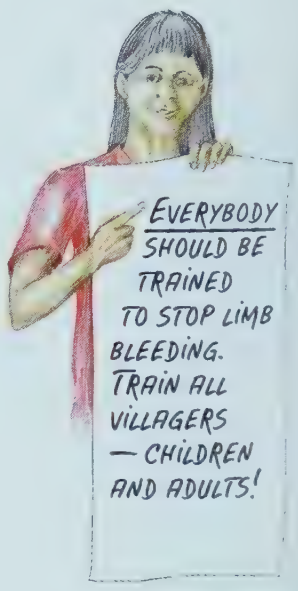
Why tourniquets don't work: See p. 32.

How to stop limb bleeding

1. **Compress the artery:** Press your clenched hand firmly on the main artery – pressing it against the bone beneath – at the inside of the upper arm and in the groin. This reduces the blood flow to the limb. Do not release the pressure before the pressure dressing is in place.
2. **Lift the injured limb** higher than the heart. This also helps reduce the blood flow.
3. **Pack the wound firmly** with gauze or cotton cloth. The wound is already filled with dirt from the explosion. So it doesn't matter if you use cloth that is not clean! Use your finger to push the cloth carefully into all spaces and pockets inside the wound. Beware: From outside the wound may look small – yet you often find a large wound cavity inside. Pack the wound completely with gauze or cloth.
4. **Pressure dressing:** Apply a firm dressing of elastic bandage on the entire limb – from the toes or fingers to the groin or armpit. Such dressing will reduce bleeding, hold the packing in place, and prevent swelling of the limb.

Now stop and look:
If it doesn't bleed through the dressing, you can gradually let go the pressure on the artery. But keep the limb lifted at all times. If bleeding continues, press on the main artery again and place another pressure dressing over the first one. Warm the victim.

Study the anatomy: See p. 209 and 210.



If it still bleeds, the packing was not good enough. Remove it, pack again and apply a proper pressure dressing.

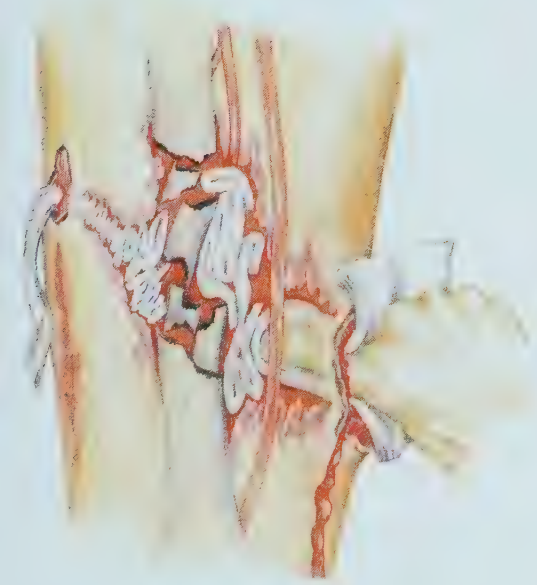
Cold blood bleeds more – keep patients warm

At all times, in all places! Even in a hot climate you become cold after injuries: Blood is warm – losing blood is losing body heat. The skin protects us from becoming cold – large wounds mean loss of temperature.

Why warming is important: See p. 56.

Three ways to warm the victim:

1. **Prevent loss of temperature:** Protect the patient from wind and rain – cover him with dry clothes and plastic. Cover the head and neck also.
2. **Warming from outside:** "Buddy-warming" – one or two helpers lie close to the victim under blankets wearing few clothes to transfer their heat to the victim. Place plastic bottles with hot water under the blankets.
3. **Warming from inside:** If at all possible, use warm IV infusions. Boil water and put the IV infusion bags into the hot water (5 minutes for 1 L infusion) before connecting them to the IV set. If the patient is awake and without injury to the abdomen – let him sip warm drinks.



Large cavities can lie behind small fragment wounds. Pack them carefully while a helper presses against the main artery.

Tourniquets are dangerous – remove them

Tourniquets don't stop bleeding: Even a tight improvised tourniquet will not compress the deep limb arteries. Nor will it stop bleeding from the bone marrow.

Tourniquets increase bleeding: A tourniquet will shut off most veins. This means that blood will pool below the tourniquet while dark blood continues to run from the wound.

Tourniquets are limb killers: Tissue that was not injured below the tourniquet will be starved of oxygen and start dying. The blood vessels are especially at risk – after more than 2 hours with a tourniquet, lots of small arteries and veins become damaged.

Also see photos p. 32-34.

Stop the bleeding – in brief

External bleeding: You can see blood flowing from the wound. Or you can see swelling under the wound due to pooling of blood.

- Remove tourniquets
- Compress artery – lift limb – pack wound – pressure dressing
- Warm the victim

Internal bleeding: You cannot see the bleeding. But you know that the victim is losing blood from the signs of bleeding – high heart rate, cold skin, low blood pressure.

- Warm the victim
- Bleeding inside the chest: Place chest tube
- Bleeding inside the abdomen: Damage control laparotomy

Intravenous (IV) cannulation

Bacteria must not enter the bloodstream. Don't touch these parts with your fingers:
- The connections between the IV bag and the IV set.
- The connections between the IV set and the IV cannula.
- The IV cannula itself.

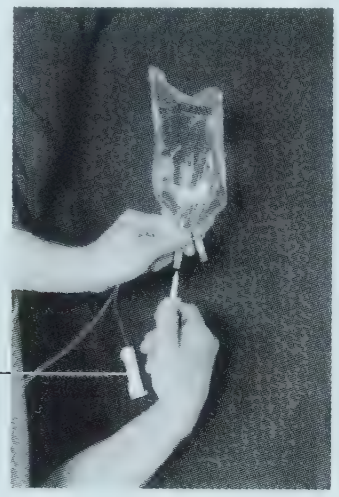
Blood lost from the body can be replaced by passing specially made sterile fluids into the bloodstream through a cannula placed in a vein. An IV cannula is a thin plastic tube with a sharp, hollow metal needle (called a stylet) inside. You use this needle to penetrate the skin and the wall of the vein. The passing of fluids through the IV cannula is called infusion.

Training IV cannulation: See p. 153.

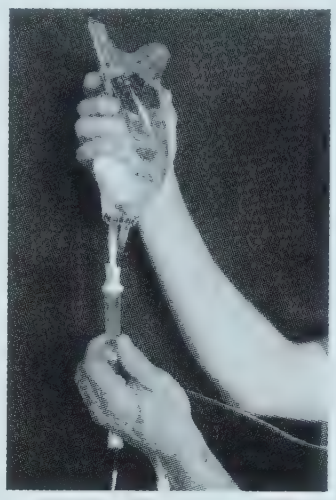
Prepare infusion bag and IV set

The infusion bag, IV set, and IV cannula are all sterile as long as the protective cover is not broken. If it is broken – don't use it.

Types of IV infusion: See p. 55 and 182.



Remove covers and caps on IV bag and IV set. Close the tap (t) before twisting the stylet into the bag's outlet.

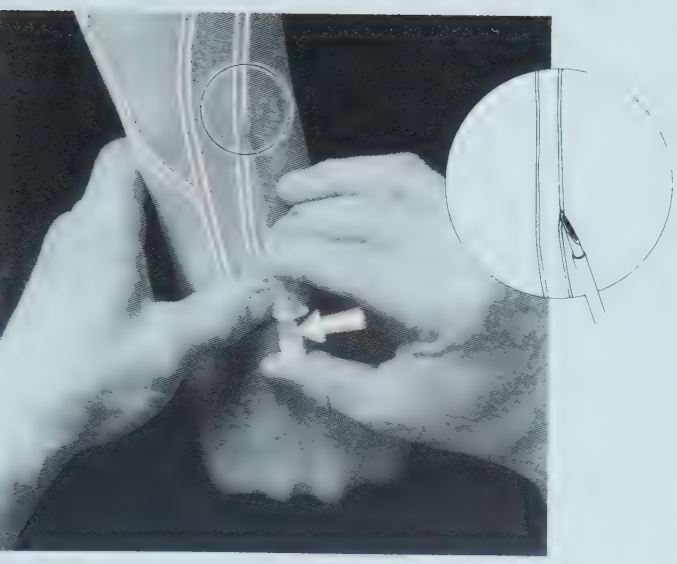


The plastic stylet is in place. Squeeze the drip chamber several times till it is half-filled with infusion.

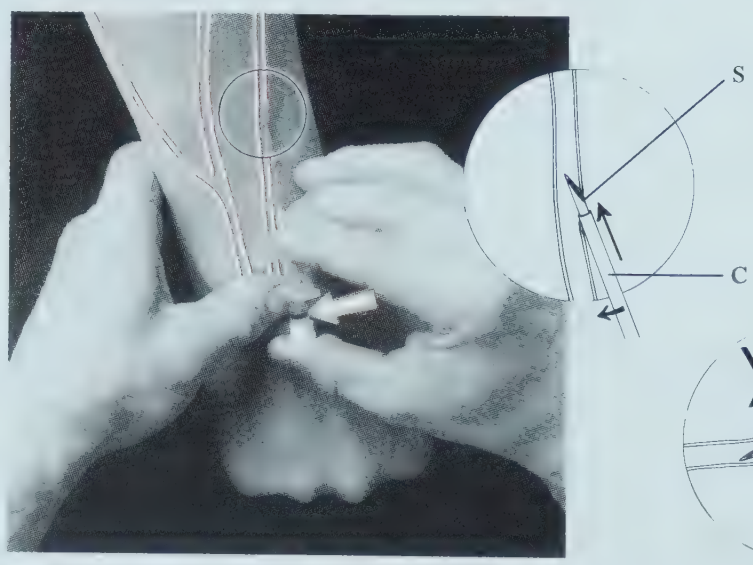
Air inside the IV set must be let out. Open the tap and let the infusion run to flush out air bubbles.

Select a large IV cannula and a large vein. Victims may start bleeding during the transport, needing a lot of infusion rapidly. If you use thin-bore cannulas in small veins, you cannot give the victim a lot of infusion – even if you squeeze the infusion bags.

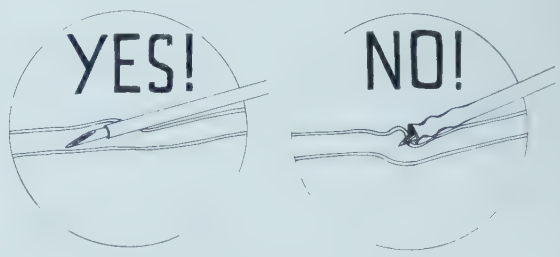
Make the vein grow bigger: Place a band around the limb above the cannulation site. Let the limb hang down, and slap the vein gently to make it grow. Tell the victim to clench his fist (or foot) ten times. Cold and blood loss make the veins collapse. If so – warm the limb by wrapping a warm wet towel around it for two minutes.



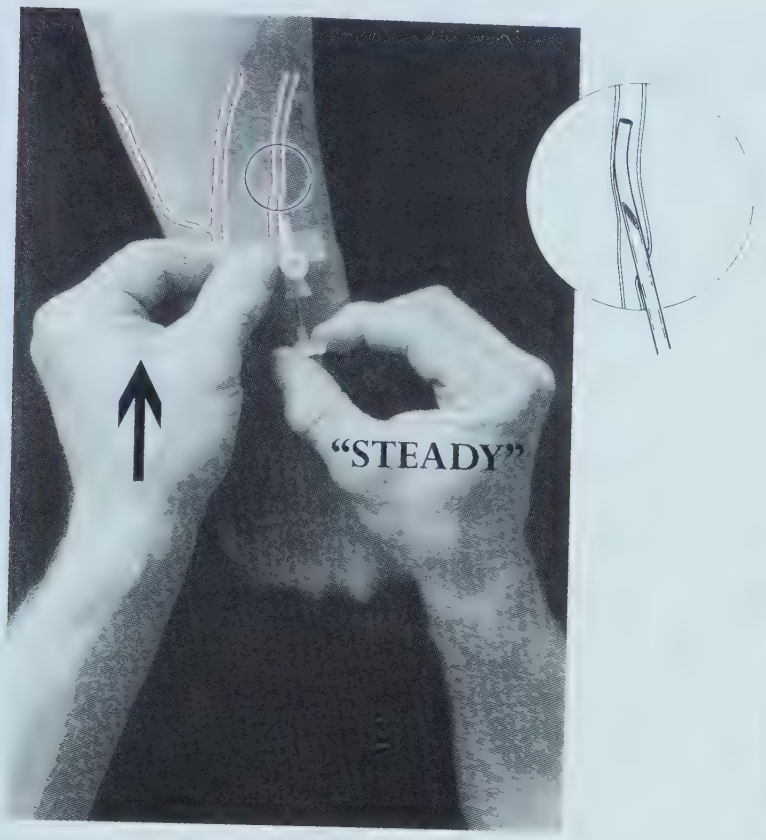
Prevent the vein from rolling off the cannula by stretching the skin with your thumb.



Blood is entering the cannula (arrow). The stylet (s) is inside the vein – but not yet the cannula (c).

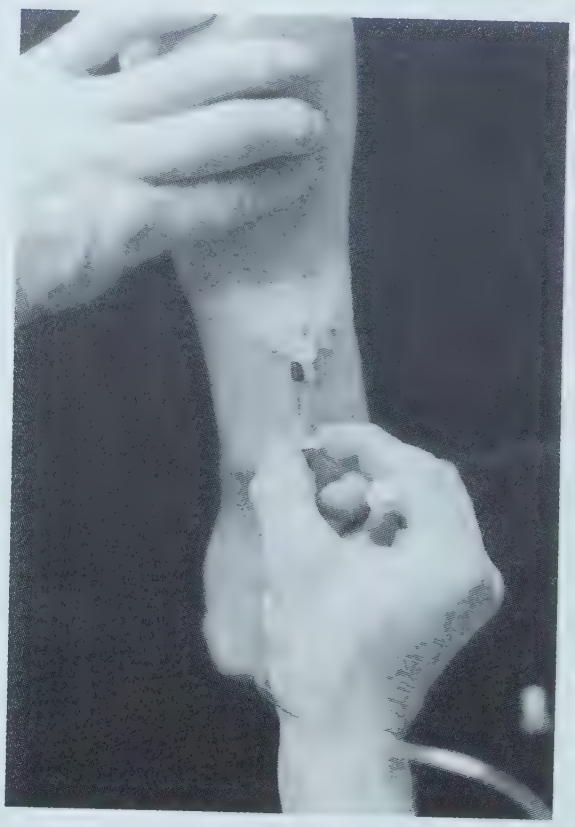


Don't withdraw the stylet yet. Slide the cannula a little further into the vein.

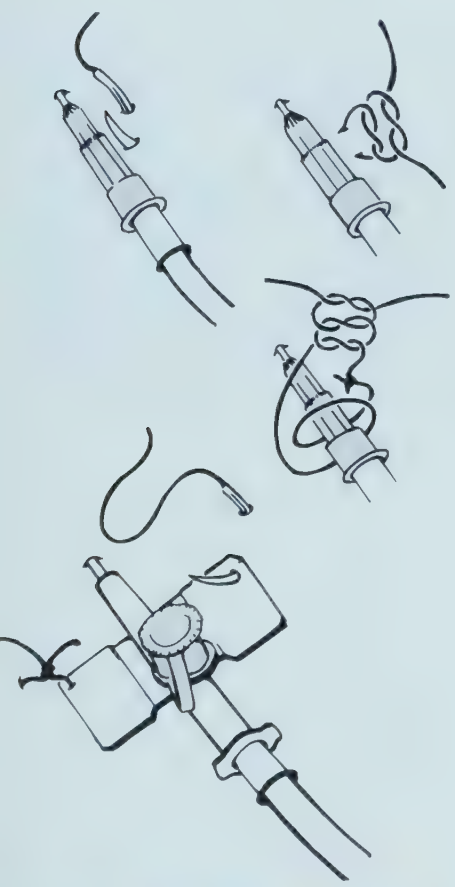


Now slide the cannula forward (use left hand) **without moving stylet** (right hand).

Fix the cannula with tape before you remove the stylet.



Press on the vein (left hand) to prevent back-flow of blood. Remove stylet, connect IV set, and open tap to start infusion.



Fix the IV cannula well: Adhesive tape does not stick well on wet and bloody skin. Oxygen-starved victims who are confused may pull out the IV lines. Or some helper may tear them out by accident. Always fix the cannulas with sutures in the severely injured and off-road transport cases.

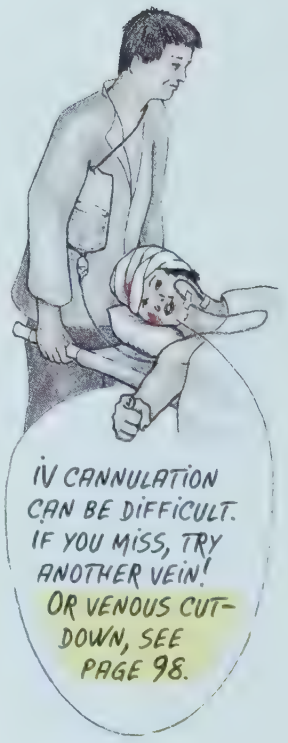
No limb veins – use the external jugular

The external jugular is a large vein running from the base of the jaw to the upper part of the chest. It becomes visible when the victim is lying flat on the back with the legs raised.

- Turn his head to the opposite side of where you will place the cannula. To see the vein better, let one helper compress the vein where it enters the chest.
- Ask the patient to hold his breath, this will make the vein bigger. Puncture the skin – ask him to breathe. Ask him to hold the breath again – and you enter the vein.

Note: Blood does not always flow back into the stylet even if the needle is inside the vein (low and slow blood-flow in this vein). When you think you are inside – connect the IV set: The fluid should run freely into the vein.

lacing the cannula in the xternal jugular vein.



Common mistakes

- You did not take your time to let the vein grow thicker after applying a band.
- You pulled the stylet back too early – the cannula was not yet inside the vein. If it swells at the vein and the drip doesn't run freely – there is no wait-and-see. Remove the cannula immediately. Compress the vein firmly for one minute. Then try again.

Replacing blood loss: Volume treatment

Rambo stepped on a M 14 US mine.

After a major blood loss, the blood circulation will collapse unless we replace the volume that is lost. We can increase the blood volume in two ways: to give IV infusions, or fluids by mouth.

Blood transfusion is for hospitals.

Rambo had all the signs of blood loss

At noon 19 October 1997 Khmer soldier Rambo stepped on a M 14 US mine and lost his foot. Fellow soldiers tried to stop the bleeding, but they couldn't. Within 30 minutes Rambo became thirsty. His heartbeats were fast and hard. His skin became clammy, and even in the sun he felt cold. People around him could see that he was breathing hard as if he had been running. One hour after the accident he was unconscious and the bleeding had stopped. They took Rambo to Sdao Hospital, to Rattana – a medic known for his skills. On arrival at 4:50 p.m. Rattana counted Rambo's heart rate at 170/min. Blood pressure less than 60 mm Hg. Breathing rate 30/minute.

Measuring blood pressure: See p. 186.

Signs of blood loss

- First signs: HR more than 100/minute. Pale, clammy, and cold skin. Thirst and no passing of urine.
- Signs of major blood loss: RR more than 30/minute. Confusion or unconsciousness. Blood pressure less than 90 mm Hg.

Rattana placed Rambo half-sitting, legs lifted, and gave him 2,000 mL warm Ringer through two IV lines. The amputation wound started bleeding again. Rattana gave him 25 mg ketamine IV, packed the wound with gauze and applied pressure dressing. At 5:10 p.m. – after another 2 liters of Ringer – Rambo was awake. His HR was 110, BP 100 mm Hg, RR 20/minute. During the further transport Rambo was given 2 liters of Ringer slowly running, and two small doses of ketamine. When they arrived at Battambang Military Hospital at 8 in the night, Rambo was in good shape.

Warming infusions: See p. 57.

Volume treatment – when?

The victim may be bleeding inside, but you don't see any blood at all. Also you cannot tell from the bloodstains on the clothes how much an amputation has bled. Young adults can take a blood loss of 1,000 mL and still have a normal blood pressure. Forget about the volume in mL lost. Concentrate on signs of blood loss, and how these signs change when you give volume treatment.

Children are different: See p. 72.

Start volume treatment if HR is more than 100/minute!
IV volume treatment is urgent if BP is less than 90 mm Hg!

2,000 mL Ringer in 10 minutes – squeeze the infusion bags!

Volume treatment – how?

Electrolytes are the base of IV volume treatment. Electrolyte infusions contain salts in the same concentration as the salts in human blood. The two most common electrolyte infusions are Lactated Ringer, and sodium chloride (NaCl 0.9%, "Normal Saline"). One is not better than the other.

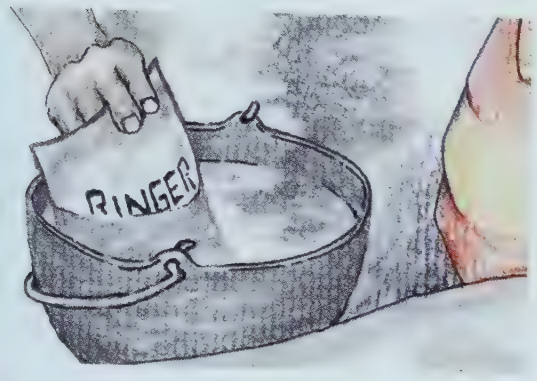
Don't use colloid infusions. Colloids are IV infusions similar to human blood plasma. That is why people call them "plasma". Recent reports show that colloids are harmful: we should stop using them.

Don't use dextrose or glucose solutions. See more on p. 182.

How much IV infusion?

1. **2,000 mL warm Ringer** through two large-bore IV cannulas in 10 minutes. Have a helper squeeze the infusion bags to increase the flow.
2. **Reassess the victim** after the first 2 liters are given: Check the skin temperature, HR, and BP. If the victim is improving, give Ringer slowly until the victim is not thirsty and can pass urine. Check these signs every 10 minutes for one hour.
3. **No improvement – another 2,000 mL Ringer** in 10 minutes.
4. **Reassess the victim** when 4 liters of Ringer are inside him.
5. **No improvement despite 4,000 mL Ringer in 20 minutes: The victim is bleeding somewhere!** See if limb wounds are bleeding through the dressing. See if you have missed bleeding wounds – remove all clothes. If you can see no bleeding, the victim is bleeding inside: See p. 90 and p. 94.

Urine production of 100 mL/hour means normal blood volume.



IV infusions should be warm, 40° C is best.

The aim of volume treatment in adults: BP at 90 mm and HR less than 100/minute within 20 minutes.

Volume treatment by mouth

If the blood loss is not severe and the victim has no signs of abdominal injury, you can give him fluids through the mouth. You can combine it with IV volume treatment to reduce costs. **Note:** Fluids take a long time to pass from the gut into the bloodstream. That's why major blood loss should be replaced by IV infusions. **How?** Prepare warm soup based on local cereals (rice, flour). Add one teaspoon of table salt to each liter. Soured milk or whey is also excellent for volume therapy by mouth (add salt). Don't use sugar solutions as sugar is poorly absorbed from the gut.

How much? Start out carefully with repeated small sips, not more than 500 mL each hour. If the victim vomits, reduce the amount.

See more on p. 183.

Volume therapy – in brief

Start volume therapy early: Prevent BP from falling under 90 mm Hg.

The key to correct volume treatment: Check for signs of blood loss every 10 minutes. There is no other way to find out how much fluid the victim needs.

Warm the victim

Cold and lonely. Get some blankets and be close to him.

The chemistry of our body slows down when the core temperature – which is the temperature of the blood – falls below 36° C.

- Less oxygen gets in: The brain works slowly, there is risk of airway block. Breathing slows down. The heart rate falls and the heart beats weaker.
- Less oxygen gets around: The red blood cells deliver less oxygen. As the platelets work poorly, bleeding increases.
- Lack of nutrition: The liver works slowly. The body doesn't get enough blood sugar which is its main fuel.

Platelets and bleeding: See p. 30.

These are the risk cases

- **Children** become cold sooner and lose more heat than adults.
- **Major blood loss:** Losing blood is losing heat.
- **Large wounds:** Skin and fat are like "the walls of the house". Large wounds are like the open doors of the house.
- **Transport on vehicles:** Wind cools our body even more. An outside temperature of 10° C with a strong wind makes us feel as cold as 3° C without wind. Victims carried on bikes and in open cars are exposed to such strong winds.
- **Rain and snow:** Water also cools the body temperature very fast – wet victims are cold victims.

Know the signs of low temperature

34° C – victim awake: The victim talks but his brain works slowly, gag reflexes are weak. HR is at 50/minute or lower. The platelets still work, but slowly – he bleeds more from all wounds.

- Watch the airway. Place in recovery position.
- Stop the bleeding before the circulation collapses.
- Warming from outside is OK. Give nothing by mouth.

Dry blankets under and over the victim.

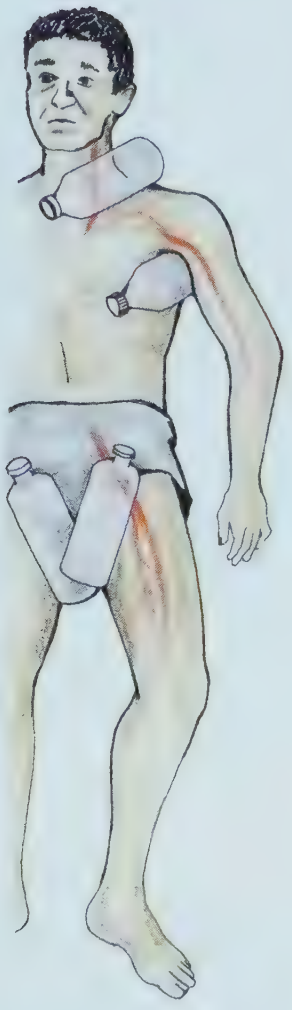
32° C – victim still awake: He is shivering. RR is below 10/minute, there is little oxygen in his blood. Even without blood loss, BP is at 50 mm Hg – the blood supply to important organs is close to collapse. He passes very little or no urine. The platelets don't work, he bleeds even from small wounds.

The victim is probably colder than you imagine.

- Place in recovery position.
- Do what you can to stop the bleeding by packing into all wounds. Apply compressive dressings on all four limbs to push the blood into the important organs.
- The situation is critical – start warming immediately. Don't overload the heart – give him at most 2 liters of warm Ringer in one hour.

30° C – eyes still open: The victim cannot speak or cooperate. HR is below 20/minute, RR around 5/minute.

- Place in recovery position!
- Beware: Rough handling of victim, rapid warming, or a lot of IV infusion may cause heart arrest.



Place bottles of warm water close to big blood vessels, and then blankets.

Prevent cooling

- **Dry:** Remove all wet clothes. Place several blankets or dry clothes under the victim.
- **Cover:** Use blankets or dry cloths. Cover especially the head and neck – those are the parts of the body where we lose most heat.
- **Wind shield:** Wrap the victim in sheets of plastic or canvas during the transport.
- **Breathe warm air:** Breathing in cold air cools the lungs and the big vessels in the chest. Breathing through a woolen scarf reduces the loss of heat.

Warming

The aim of warming: Body core temperature at 38° C. At 38° C blood clotting is best, and the chemistry of our body is most efficient.

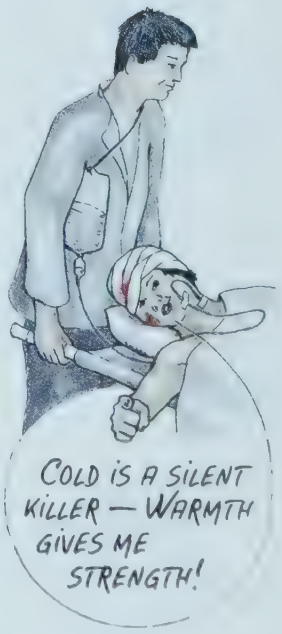
Victims who bleed and victims who are critically cold – give them IV infusions at 40-42° C. The blood temperature falls a lot if you give a bleeding victim 2 liters of Ringer rapidly – with the infusions at room temperature only. This is to ask for bleeding problems! You can warm the infusions this way:

- One infusion bag of 1 liter from the refrigerator – put in boiling water for 5 minutes (don't remove the outer protection).
- One bag, 1 liter, at room temperature (20° C) – put in boiling water for 2 minutes.
- If there are no facilities for boiling – place the bags inside the clothes in a helper's or your armpit to "buddy-warm" them. Then place them under the victim so that his own body weight can be used to squeeze the fluid through the IV line. But first all air has to be expelled from the IV bag and the infusion set – else air can be squeezed into the blood vessels.

'Buddy-warming": A friend r the medic sits or lies close to he victim, folding his arms round him – both wrapped in he same blanket and plastic heet. This is an excellent way o warm both body and soul.

Warming by the gut

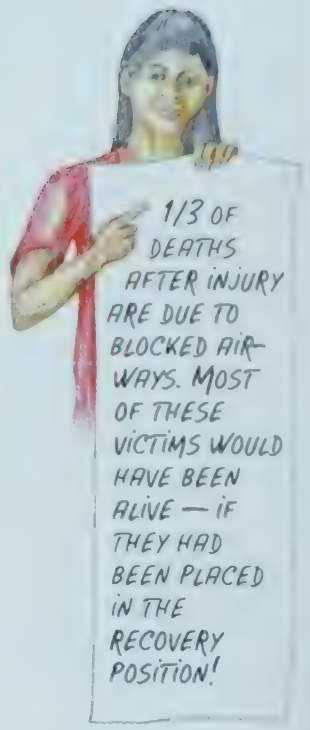
- Give nothing by mouth. Gag reflexes are weak in cold victims. By letting them drink, you risk blocking their airway.
- Warm enema is very efficient: Explore the rectum with your finger – if there is no blood on the glove, you can use enemas. Introduce 1 liter of warm water (warmer than your skin). Empty after 5 minutes and repeat.



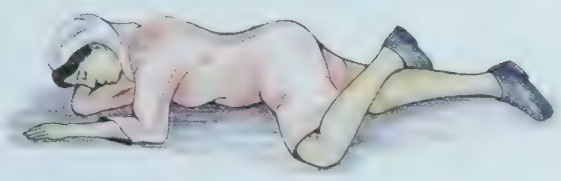
Warm the victim – in brief

Warming is an essential part of basic life support – even in the tropics. Never evacuate a victim until you have done what you can to keep him from becoming cold.

Victim's position



It is no use doing a good job at the accident site if the transport to hospital is carried out carelessly. Let's say the victim has a head injury. You do excellent work at the site of injury – head tilt, chin lift, suction of airway. But the victim is carried to hospital lying flat on his back; he falls unconscious, vomits – and drowns in his own vomit. That was an unnecessary death. The very simple, yet crucial thing you forgot was the recovery position for him.



Recovery position.

Airway – more important than breathing – more important than circulation

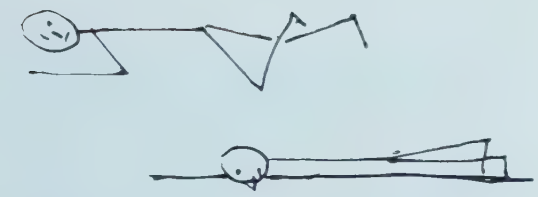
- If the victim has an airway problem: Place him in the best position to protect the airway – recovery position.
- If the airway is OK: Place him in the best position to support the breathing – half-sitting.
- If the main problem is major blood loss – and the airway is OK: Place him in the best position to support both the breathing and the circulation – half-sitting, legs lifted.

Recovery position. The face is towards the ground.

Airway problem: Recovery position

Victim with head injury. Or victim who is or may become very weak. Or victim who is or may become unconscious. Or victim who had morphine, buprenorphine, or diazepam: Place him in the **recovery position immediately** at the site of injury and at all times during the transport. Tilt the victim's head slightly backward to open the airway – at least don't bend it forward. Also twist the head face downward – so that the tongue will not slip backward and block the airway.

Types of airway problems: See p. 46.



Mark recovery position or face-down position like this in the Injury Chart (see p. 81).

Victim bleeding in the mouth or the throat. Or victim with severe face injury: **Face-down position immediately** at the site of injury and at all times during the transport. Cut a hole for the victim's face in the stretcher and let him lie flat on his belly. This allows the blood to run out, for the tongue to slip forward, and for fractured parts of the jaws to slip forward.

See case story p. 46.

No airway problem: Half-sitting

The airway is open, the victim awake, no head injury. But there is blood loss. Or chest injury. Or abdominal injury: **Half-sitting position, legs lifted** at the site of injury and during the transport as long as the victim is awake. The half-sitting position promotes deep and efficient breathing. Lifting of legs drains blood from the legs and increases the blood supply to the important organs.

Half-sitting position.

Major blood loss: Half-sitting position with compressive dressings on four lifted limbs. When there is a shortage of blood, we must get as much oxygen as possible into the blood – that's by using the half-sitting position. Still life is at risk due to the blood loss. Hence, the blood that is left should be pooled in the important organs, and not in the limbs: Lift both legs for 2 minutes. Then apply very tight compressive dressings with elastic bandages from toes to groin. Let both legs remain lifted at all times. Do the same with both arms.

Do not place a victim who has lost a lot of blood in this position.

Place him in this position. This is the correct "shock position" for victims with major blood loss who are awake.

Special for spinal injury

There is paralysis, numbness, or radiating sensations to one or more limbs. **Or** there is severe pain when the victim moves the neck. This shows that there may be fractures to the spine. Careless movements – especially tilting the head forward – may permanently damage the spinal cord.

- One helper should support the neck by pulling slightly on the head at all times during lifting and transport until X-ray examination shows that there is no unstable spinal fracture.
- Four helpers are needed to lift the victim in one piece without bending the spine: One helper supports the neck, two helpers lift the body, one helper supports the legs (coordinated spinal lift).
- Spinal injuries may cause airway problems: Place the victim in the recovery position, but don't tilt the head.

Special for child victims

Small children breathe through the nose, not the mouth. All children are extremely afraid after an accident.

- Don't cover a child's nose or eyes with dressings. He will feel as though he is being suffocated.
- Stay close to all child victims at all times. Being afraid increases the pain and impairs the breathing. Give them your hand. Even better: have a helper hold the child close in his arms. That will keep the child warm as well.

More on life support for children: See p. 72.

Special for pregnant victims

All victims more than three months pregnant: Let them lie on their **left side** at the injury site and at all times during the transport. Most pregnant women are anemic prior to the accident. The fetus is very vulnerable to oxygen starvation. Hence, the mother cannot take much of blood loss before the fetus is at risk. Lying on the left side gives the best blood supply to the uterus (womb).

Victim's position – in brief

Correct position can be life-saving.
The two main positions are:

- Recovery position for cases with airway problems.
- Half-sitting, legs lifted for most other victims.

Drugs for pain

Adrenaline – friend and foe

Pain is dangerous – and unnecessary. Give ketamine pain relief.

Friend: The body reacts strongly to injury and pain. Immediately after an injury or when we are in danger, it pumps a chemical substance called adrenaline into the bloodstream. Adrenaline gives us strength: It increases the breathing. It makes the heart beat stronger and faster. It tells the defense systems of the body that they need to act. The immediate pain after the injury helps the body get ready to fight infection.

Foe: Continuous pain during the journey to hospital is dangerous. It causes the breathing to become too rapid and superficial. The heart rate and blood pressure rise more than necessary, and cause more bleeding. Continuous pain tires the victim and weakens the body's defenses.

This is why you must relieve the victim's pain from the moment you first treat the victim, all the way to the hospital.

The pain problem in mine victims

A mine accident happens suddenly, often in a peaceful setting. There is no warning, and no signals that prepare the victim for danger. He is caught totally unprepared, so the body and mind are unprotected from injury when the mine explodes.

The pain goes on: Due to the suddenness of the accident, many mine victims still suffer from pain and mental disorders after the wounds are healed. When the person is back in the village after successful treatment at the hospital, the pain continues day and night. It may be pain in an amputated limb, or in the foot which is not there anymore ("phantom pain"). Or it may be general pain in the entire body. This is called chronic pain. Chronic pain causes mental depression, and the victim may feel that life is meaningless. Some victims are continually reminded of the accident. Simple daily events like sudden bangs, the smell of fried meat, or other impressions remind them of the terrible accident. It is as if their life had stopped at the time of the accident.

Chronic pain is a common problem in mine victims.

Early and good pain relief prevents depression and other problems: Chronic pain and depression are difficult to treat. Early and good pain relief immediately after the injury help prevent such problems. Children injured by mines are more likely to suffer from chronic pain and depression. Early pain relief and comfort are very important to children.

More on comfort and encouragement: See p. 61.

Drugs to reduce pain (analgesics)

Give repeated IV doses, not IM: Painkillers should be given intravenously (IV), because the drug works better and faster. If the victim has lost much blood, intramuscular (IM) injections have little effect. Give the drug in repeated, small doses. Wait to see the effect of one injection before giving the next. If the intravenous route is not possible, analgesics can be given IM.

Ketamine is the drug of choice

Ketamine is a powerful and safe analgesic. It does not affect the gag reflex, so victims can protect their airway. It does not reduce the breathing or cause vomiting. Also, ketamine increases BP and HR and thus helps blood circulation. The drug may increase salivation, especially in children. Some patients get hallucinations and lively dreams, but usually not enough to cause problems during transport. Ketamine has less side-effects and works better than other analgesics.

IV ketamine pain relief

- Give 0.2-0.3 mg/kg body weight of ketamine. That is 15-25 mg IV for an adult. This dose acts within 30 seconds, and the effect lasts for about 10 minutes. Give the next dose when you can see that the victim starts to feel more pain.
- Sometimes too much salivation can block the airway. Atropine can stop salivation. You should give a single IV dose of 1.0 mg atropine (adult dose) IV before giving ketamine.
- Give diazepam 2.5 mg IV to prevent unrest and hallucinations: Note: Repeated doses of diazepam are dangerous if the victim has lost a lot of blood.

Details on doses and drugs: See p. 178-181 and pocket folder at the back cover.

Don't use diazepam in children: See p. 72.

The correct dose is the dose that relieves pain

People react to drugs in different ways. There are big differences in the way each person reacts. The doses listed above are only guidelines.

Pentazocine is an analgesic much like morphine. In normal doses, it may reduce breathing, HR and BP – especially in children. Give an IV dose of 30 mg (adults). This takes effect within 2-3 minutes, and lasts for 2-3 hours. The dose may be repeated, but watch the breathing. Pentazocine does not cause salivation or bad dreams, so atropine and diazepam are not needed.

Other analgesics are morphine and buprenorphine. We do not recommend them because of their serious side-effects. They are strong analgesics, but cause vomiting, especially during bumpy journeys to hospital. They depress breathing more than pentazocine. Another strong analgesic is alcohol (given to the victim to sip). But you should first consider both its medical side-effects and any cultural reasons for not using alcohol.

See case story p. 112.

Drugs for pain – in brief

- Give pain relief immediately. Go on giving it all the way to the hospital.
- Ketamine is the drug of choice in victims with a lot of pain.
- Analgesics should be given IV in repeated doses.
- Comfort and encouragement are as important as drugs.

More on pain relief: See next page

Comfort and encouragement

The sudden blast of a mine explosion frightens everyone. Try to imagine the feelings of the victim when the mine goes off. He may think: *Am I going to die now? Will I see my family again?* The terrible pain of being torn apart makes the victim believe that death is near.

Because there is no warning, the injury strikes a person who is not prepared.
This is why chronic pain and psychological problems are common in survivors of mine accidents.
It is also why immediate comfort and encouragement are very important for mine victims.

Be close at all times.

Body and mind must resist together. We all feel abandoned and helpless if we are left alone. We become very sad and give up easily. To reduce the bad effects of adrenaline, we must control fear and reduce pain. Support by kind and friendly people around us will give us the courage to fight pain and control fear.

More on pain and adrenaline: See p. 60.

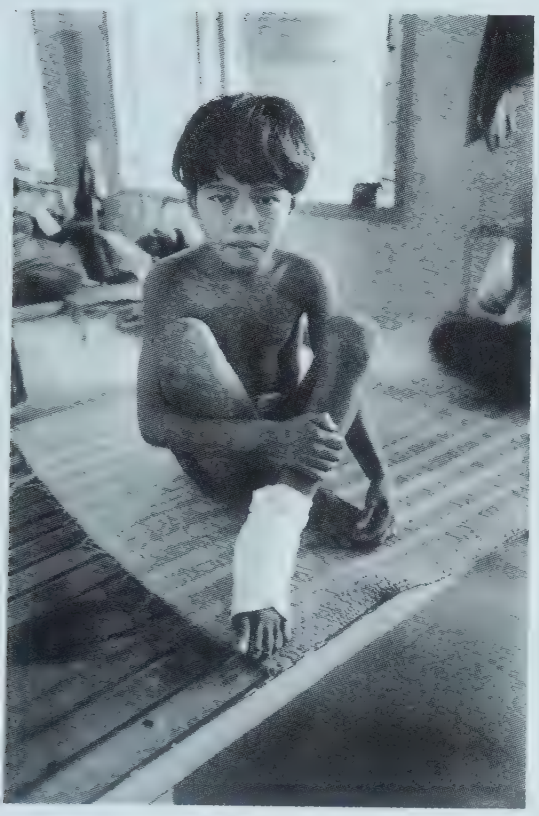
The best comfort is human touch and the human voice: Even as babies and small children, we feel safe when we feel other people close to us or hear human voices. It means that we are not alone. When we are injured and in pain, we need even more to feel that we are not alone.

How to comfort in the field

Be close. If the victim has to wait to be rescued from a minefield, then shout or talk to him from a distance. Explain why you are waiting for help. Tell him you will not go away. As soon as the victim is in a safe place, get close to him. Stroke the victim's face, just as you would comfort a child. If you have helpers, let one person sit next to him, folding their arms around him, or just holding his hand.

Even if he is unconscious, hold his hand and talk.

Talk. Look him in the eyes, and tell him exactly what is going on and what you plan to do. Tell him that you will stop the bleeding, keep him warm, take away the pain, and get him to the nearest hospital. Go on talking to him all the time. Listen to his complaints. Use encouraging words such as: *You can get through this! We can do this together!*

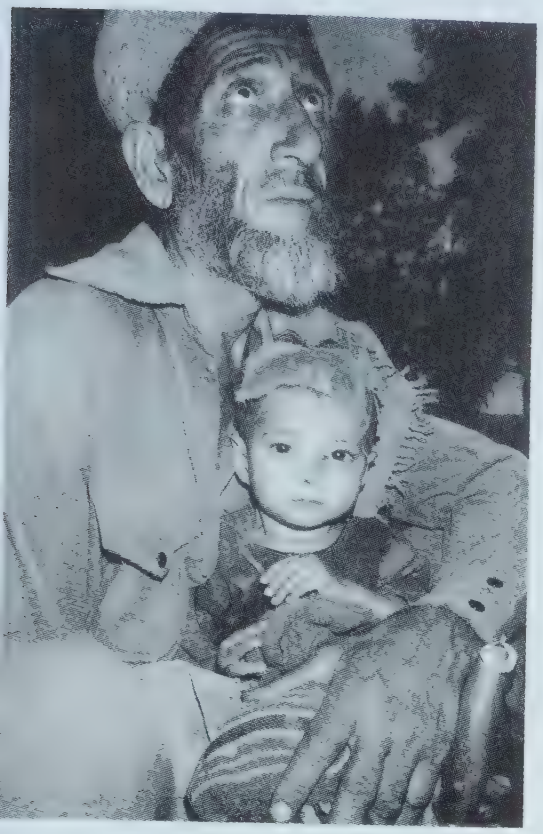


The silent child.

Be firm, don't allow the victim to give up. Some victims give in to pain. When the pain becomes too much for them, you can see it on their faces. Do not let them give up – unless it is a hopeless case. Shake their shoulders and tell them: *You must wake up, and stay alive! We will stay with you and help you!* Remind them that they have a family who needs them – alive.

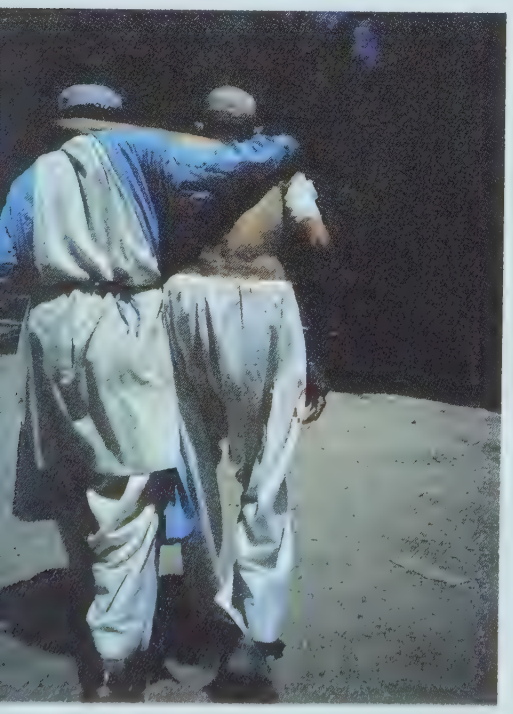
The injured child

The silent child: A child is even less prepared for a mine accident. You will probably find the injured child pale, quiet, and only sobbing a little (rather than crying). This is because the child is numbed by the emotional shock, and does not understand what has happened.



Afghan father and child during an air raid.

Let him lean against you.



close at all times.

Find the relatives: The injured child needs to have someone that he knows well close to him. The best person is one of the parents. They should be with the child at all times all the way to the hospital. If you cannot find the parents, find another relative, or someone else that the child knows well.

Stay close to the child: If the child is small, put him on your lap while the others are examining the injuries and stopping the bleeding. Rock the child carefully, talk quietly and reassure him. Stroke the child on the head and chin. Keep him warm with your body.

Comfort during treatment and transport

The mine victim will ask: *Will it hurt? Is the leg lost? Will I die?* Even if he does not ask these questions, he is thinking about this all the time.

Inform him before you start treatment: Explain in simple terms what you are going to do when you arrive at the injury site, and later on the way to the hospital. Encourage him and give him hope – but do not lie. Telling the victim what you are doing helps the victim understand the situation and helps give him the strength to fight the injuries.

Be honest: If you promise to take away the pain, do so before you start painful procedures. Get the IV cannula in quickly, give the first dose of ketamine immediately. If possible, do not start any painful treatment before the ketamine works and the victim is almost pain-free (1-2 minutes after the injection).

Comfort during the transport: Have at least one companion stay close to the victim on the way to hospital. Sit by the victim's head to support it if the victim is weak. Or let the victim lean against you or a helper, folding the arms around him. In this position you can comfort and warm the victim. At the same time you can check if he is awake, how he breathes, and you can easily check the carotid pulse at the neck.

Draw on the family

The victim needs his family in this difficult situation. But the family also needs the victim to stay alive, with as little permanent damage as possible. Arrange to have one or more family members stay with the victim at the hospital. When the victim has passed through the days of emotional shock, usually 2-3 days after the accident, he starts to think about his future. He thinks about how he can go on living. At that time and for weeks afterwards, the family should be at his side.

Comfort and encouragement – in brief

Never let the victim alone. The best comfort is a warm hand and the human voice.
Inform him. Be honest, yet give him hope. If the victim is giving up – do not let him.
Draw on the family's support.

Prevent infection. Antibiotics

You can prevent wound infection in three ways:
- Most important – restore the breathing and blood circulation as soon as possible after the injury.
- Less important – do not place bacteria in the wound yourself.
- Least important – give antibiotics.

How to work cleanly: See p. 106.

Don't use tourniquets. Cambodia 1998.

Help the body prevent infection

Millions of bacteria are inside the wound immediately after the injury. Six hours later, the number of bacteria has multiplied many times. Then there is a local infection in the wound. You must fight it so that it does not spread.

Eat the bacteria

The blood contains white blood cells that can identify and eat bacteria. Restore the blood circulation as soon as possible after the injury so that these cells can get to the infected wounds.

Starve the bacteria to death

The main food for bacteria is dead tissue in the wound. More and more cells around the wound will die unless oxygen gets to the wound area. These dying cells are extra food for the bacteria. This is why you have to get enough oxygen-rich blood to the wound as soon as possible after injury. Stop the bleeding, flush with IV infusions, and get the blood pressure up to 90 mm Hg as soon as possible!

If no bleeding problem: Keep the wound open with fluffy gauze drain. Never close a mine or war wound.

Do not use tourniquets

Remove tourniquets as soon as possible. Tourniquets close the blood supply to the wound. Using tourniquets only encourages infections.

More on tourniquets: See p. 32 and 50.

Remove bacteria and dead tissue

Having eaten the bacteria and dead cells, the white blood cells carry them to the wound track. This forms a discharge (pus) from an infected wound, and is the body's natural way of cleaning the wound.
Drain: When the bleeding is stopped, you should leave all mine and war wounds open using a fluffy gauze drain inside to allow the discharge to come out.
Debridement within 8 hours: Debridement means cutting away dead tissue from the wound. It is a surgical procedure done in hospitals. So get the patient to the hospital as soon as possible.

Least important: Antibiotics

Antibiotics are drugs that kill bacteria. But note two points:
- Antibiotics can only reach the wound site when the area has blood supply.
- Antibiotics are carried through the blood, and the bacteria live in tissue without blood supply. So antibiotics do not at all reach the source of the wound infection, the bacteria in tissues without blood supply. They only reach the area around the wound.

So antibiotics do not cure the infection, they only delay it and help prevent it from spreading.

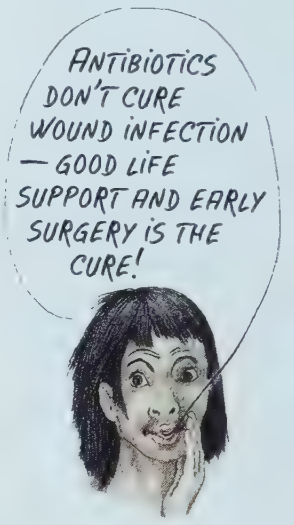
How to use antibiotics

Watch out for allergy

Some patients are allergic and cannot take certain drugs. In taking those drugs, allergic victims can have difficulty in breathing, swelling of the lips and the mouth, and skin rash. Ask all victims if they ever had skin rash from an antibiotic drug. If you suspect allergy, don't give the antibiotic. Treatment of sudden allergy: Watch the airway. Give IM adrenaline 0.5-1.0 mg to adults. 0.1 mg/10 kg body weight to children.

Give antibiotics only for deep injuries

Infection is rare in wounds which are not very deep. You should only give antibiotics to victims with deep wounds – that is wound tracks that penetrate the muscle fascia and enter the muscle, the chest, or the abdomen.



Give IV dose, not IM nor on the wound

Antibiotics must be carried through the bloodstream to be effective. Antibiotic ointments applied to the wound have no effect. Antibiotics are only slowly absorbed from the muscles into the bloodstream after an IM dose. IM antibiotics are hardly absorbed at all if the victim has lost a lot of blood.

Which antibiotic should you use?

The drug you choose depends on the type of injury because different types of antibiotics kill different types of bacteria.

- Benzyl-penicillin for limb and head injuries: Give a single IV dose of 10 million IU. If you are far from the hospital, you may give one more dose after 8 hours.
- Ampicillin for chest injuries: Give one IV dose of 2 grams. You may repeat after 8 hours if the hospital is far away.
- Ampicillin plus metronidazole for abdominal injuries: Fragments hitting the lower part of the chest often injure abdominal organs. Treat those injuries as abdominal injuries: Give one IV dose of 2 grams ampicillin. Add 1.5 grams metronidazole as IV infusion. You may repeat the ampicillin dose if the hospital is more than 6-8 hours away.

Doses for children: See p. 178 and pocket folder at backcover

Metronidazole infusions are expensive. See p. 178 for alternative antibiotics.

Prevent tetanus

If the victim is vaccinated: give a booster of vaccine. If not vaccinated: give IM tetanus immune globulin 250 IU for major wounds late for treatment. The best prevention is still early high IV dose of penicillin, good life support in the field, and early debridement of the wound.

Prevent infection – in brief

Support for airways, breathing, and circulation comes first.

Then start with the antibiotics. But remember: Antibiotics only work on one condition: that the blood circulation is restored.

Victims need food

Malnourished, dying mine victim at the hospital. Cambodia 1997.

After major injuries the need for energy is doubled

All chemical reactions in the injured body are set at a higher speed to maintain the oxygen supply to the tissues, and to rebuild the damaged tissues. The cost is an increased need for "fuel", or energy. It is even more important to start early high-energy nutrition for exhausted victims (wartime refugees), malnourished victims (in hunger areas), and victims weakened by severe diseases. Their stores of energy inside the body (liver glycogen and fat) would have already been emptied by the time of injury.

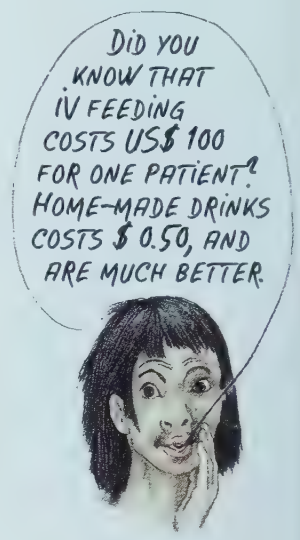
More on diseases and starvation: See p. 76 and 162.

The diet must be balanced

Carbohydrate, protein, and fat are the three basic elements of food. Fat is the nutrient that produces most energy when it is "burnt" inside the body. However, the body cannot fully utilize a diet based only on fat, or only on carbohydrate. The diet must be a balanced composition of all three food elements. Therefore you should learn how to give victims a well-balanced and nutritious diet based on local foodstuffs.

All victims need food within 12 hours after injury.

- But victims weak from blood loss and victims who are not fully awake cannot swallow safely – they must be fed by a stomach tube!
- Never feed victims with wounds to the lower chest or the abdomen. The intestines are not working, there is risk of breathing difficulties and vomiting!



The victim can be fed in three different ways during transport to the hospital:

- By mouth: The victim takes in food and drinks with high-energy contents. This is the simplest way.
- By stomach tube: Home-made feeding solutions are passed down the tube.
- IV feeding: Extremely expensive and inefficient.

Diets for oral feeding

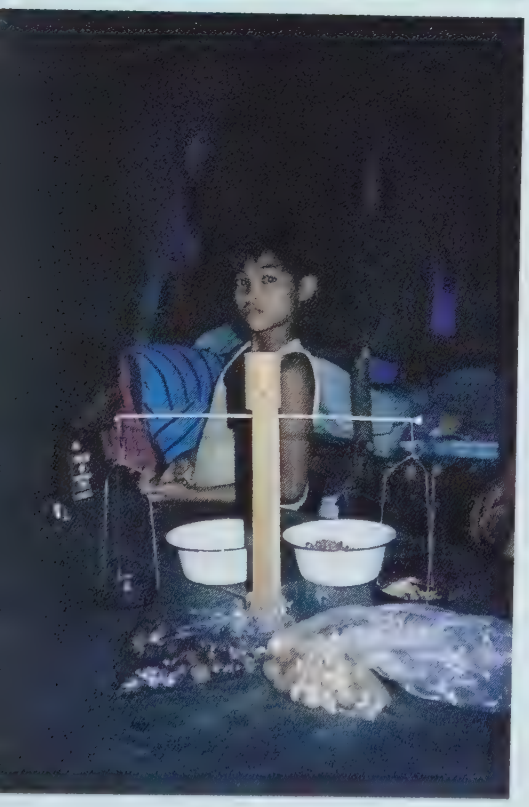
Local foodstuffs are the best

The tolerance for foodstuffs differs among the different cultures and countries. This is due to differences in the bacterial content of the gut, differences in physiology, and in cultural tradition. Your victim will utilize better a diet based on foodstuffs he is already used to.

Local foodstuffs are the safest

There are high-energy biscuits and other pharmaceutical nutrients available in the market or donated by NGOs. However, villagers have neither refrigerators nor the tradition in preparing such ready-to-eat food. Hence there is a risk in taking this easy way, as these nutrients may become contaminated during storage and preparation. But villagers have generations of knowledge handed down on how to process meat, fish, fruits and vegetables for storing. Thus the well-known local way is the safest.

Drinks or tube-feeding can also be used to replace blood loss: See p. 55.



ocal foodstuffs and traditional rocessing are best. Mindanao 986.

Given below are examples of common diets based on local cooking traditions. They are all tasty and rich in energy. Boil well or make porridges to make the food easy to swallow. Three litres a day of these diets cover the body's need for water and energy.

Central Africa

1. 800 g bananas, 200 g roasted ground peas, 75 g dried skimmed milk, water. Content of 1,000 mL: 2,300 kcal.
2. 300 g cassava, 150 g meat, 50 g tomatoes, 50 g onion, 25 g red palm oil, water to make 1 liter. Content: 1,500 kcal.

North Africa

1. 600 g potatoes, 150 g dark green vegetables, 80 g bean flour, 20 g oil, water to make 1 liter. Content: 1,000 kcal.
2. 160 g tef flour, 80 g bean flour, 100 g dark green vegetables, 25 g oil, 20 g sugar, water to make 1 liter. Content: 1,200 kcal.

South-East Asia

1. 125 g wheat flour, 100 g beans, 200 g spinach leaves, 125 g carrots, 25 g ghee, 250 g bananas, 250 mL milk, water to make 1 liter. Content: 1,700 kcal.
2. 280 g rice, 120 g fish, 80 g onion, 20 g oil, 20 g clear fish soup, 20 g malt, water to make 1 liter. Content: 1,400 kcal.

Diets for stomach tube feeding

Pass a naso-gastric tube with a diameter of at least 5 mm through the victim's nose. The tube will deflate his stomach and can also be used for feeding. The food mixtures listed above will be too "thick" and sticky to pass through even a large-bore tube. It is the starch content in foodstuffs like potatoes, flour, bananas, and cassava that makes the feeding solutions sticky. To prevent blocking of the naso-gastric tube, the starches in the diets listed above have to be malted before they can be used in the feeding solutions for tube feeding. Malting is an old technique used in traditional food processing worldwide, probably known to some of the old women in your village. Malted food is more nutritious, and also stores better.

To place stomach tubes: See p. 49.

How much food should you give?

Let the victim drink – or pass through the tube (use 50-mL syringe) – 150 mL at one hour's interval. Give less if he vomits. An injured victim weighing 70 kg needs around 3,000 kcal/24 hours. That is 2-3 liters of the diets listed above. He may even need 4,000 kcal if he has a major injury.

High-energy feeding – in brief

Feeding is part of life support: All victims need food within 12 hours after injury – child victims even sooner than that.
On news of an accident, somebody in the village should immediately start preparing the food.
Study the technique of malting.

Also see p. 183.

Not awake and no breathing

Is he dead?

Is he breathing? Training in CPR on dummy, Angola 1997.

If a person does not respond when spoken to, he may have fainted, be very cold, severely injured, very sick, or just drunk. A person who does not respond and is not breathing is dying or dead. To find out if he is dead, or to help him if he is not yet dead, examine the airway, breathing and circulation as described below. Unless you are completely sure that a victim is dead, you should try to save him.

See the story of a boy who drowned: P. 110.

Examination of a lifeless person

1. Awake? Always start by speaking to a victim. If he does not respond, you should gently shake his shoulders, and ask again: "Are you OK?"

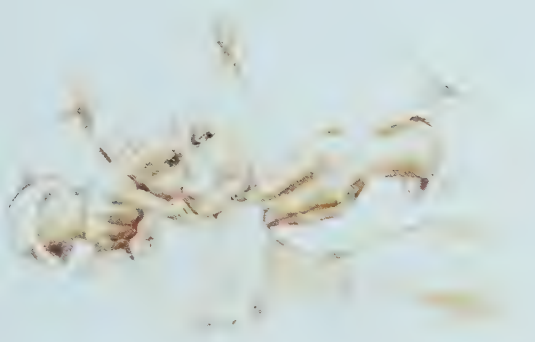
2. Airway: Open the airway by tilting the head back and lifting the chin. Loosen any tight clothing around the victim's neck. Use your fingers to remove foreign bodies from the mouth. Now you know that he has an open airway!

Airway control: See details on p. 46.

3. Breathing: Look for chest movements. Place your ear to his mouth, listen for signs of breathing and feel for warm air against your ear. Check for at least 5 seconds before deciding that there is no breathing. If there is no breathing, you must give 2 rescue breaths right away.

4. Circulation: Does the victim respond to the rescue breathing? You must check if there is blood circulation. Feel for the pulse beat in the carotid artery. If the victim did not start breathing on his own, and no pulse can be felt, there is no blood circulation. This means that the heart has stopped.

Check the pulse: See p. 45.



CPR in adults: 2 rescue breaths

This is heart arrest

If the victim does not respond when shaken, does not breathe, and has no pulse in the carotid artery – his heart has stopped. This is heart arrest. No blood is reaching his brain. He is dying, and only prompt and fearless action from you can save his life.

Examination of a lifeless child

The steps to examine a lifeless child are slightly different:

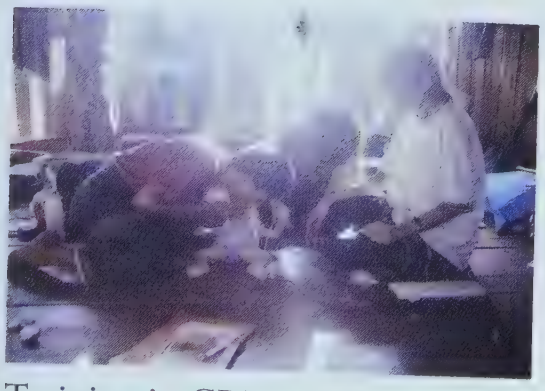
- **Airway:** Do not extend the neck too far back when doing a head tilt. Do not press on the tongue when you lift the chin.
- **Breathing:** If there is no sign of breathing, give 5 rescue breaths (see opposite page). Then check the pulse.
- **Pulse control:** In infants, check for the pulse inside the upper arm.
- **Keep warm:** Children lose heat even faster than adults do. Be careful to keep the child warm.

More on life support for children: See p. 72.

– and 15 chest compressions.

Cardio-pulmonary resuscitation (CPR)

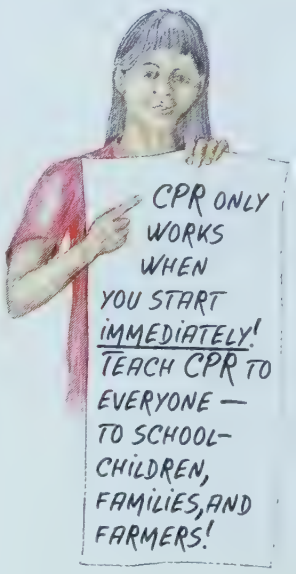
CPR is a way to restart a heart that has stopped. CPR combines two techniques: Chest compression to maintain the blood circulation



Training in CPR on infant dummy, Burma 1993.

while the heart is not beating. And rescue breathing to maintain the breathing while the victim is not breathing on his own.

CPR in adults: 2 rescue breaths for every 15 compressions
Give two rescue breaths. Immediately after this, press down on the chest 15 times. Continue in this way, giving 2 breaths for every 15 chest compressions. If you are alone, you have to change position from sitting beside the victim's head to sitting beside his chest. If there are two first helpers, one does the rescue breathing, while the other compresses the chest.



CPR in children: 1 rescue breath for every 5 chest compressions.

- The rescue breathing: Place your mouth over the child's mouth and nose, and fill his lungs until you see the chest rising. But do not fill the lungs too full.
- The chest compressions: Use one hand for a child, or only two fingers for an infant. Press rapidly downwards approximately 100 times per minute. Check that the chest compressions make a pulse in the carotid artery at the neck, or in the femoral artery at the groin.

ulse check, rescue breathing, nd chest compression in hildren.

Advanced CPR

If you have the equipment and skills, you should place an IV cannula and give an IV injection of adrenaline. But do not stop the CPR. These things should be done at the same time as the CPR.

- IV Ringer is useful for all victims with heart arrest. If the heart has stopped due to injury and blood loss, the victim has probably lost a lot of blood. Give a lot of infusion.
- As soon as the IV cannula is in place, give IV adrenaline 1 mg. Then do 10 cycles of CPR (2 rescue breaths followed by 15 chest compressions), and give 1 mg adrenaline once more.
- Continue CPR until the heart starts beating, he starts breathing on his own, or wakes up. Or, until you and your helpers are too tired to go on. If you are this tired and the victim has not responded, the victim is dead and cannot be saved.

Doses of adrenaline: See pocket folder at back cover or p. 180-181.

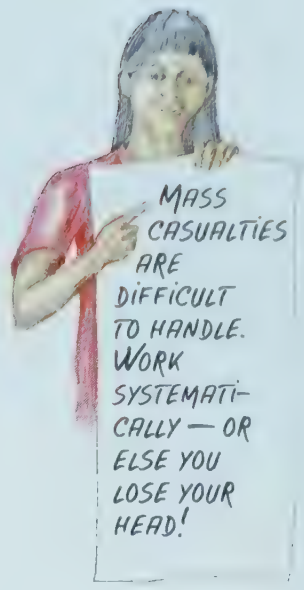
Advanced CPR for adults and children – in brief

- Examine the victim: Awake? Open airway? Breathing? Pulse?
- If none of these, there is heart arrest. Start CPR: 2 rescue breaths for every 15 chest compressions in adults, 1 breath to 5 compressions in children.
- Place IV cannula, and give adrenaline. Give 10 cycles of breaths-compressions. Then reassess. If no improvement, continue CPR and give more adrenaline.
- If there is still no response and you are too tired to continue, the victim is dead.

Mass casualties

Managing mass casualties from an air raid, Afghanistan 1990.

A mass casualty involves several victims at the site of injury.



It is easy to miss a serious injury

The scene is chaotic with many patients, lots of blood and crying. The silent child with breathing difficulties or the patient with a partial airway block may be overlooked. The person with airway block due to head injury or the silent one with internal bleeding and low blood pressure is often missed. In this chaos you must stay cool and think clearly. It is easy to miss a serious injury unless you follow a special plan for life support.

A life-support plan for mass casualties

- **You are the leader.** When you enter the site of injury, immediately make it clear to everybody that you are in charge, that they give information and pose questions to you.
- **Find helpers.** You need two or three helpers. Shout: *Anyone who has some experience of training in first aid, come forward!* Tell them to follow you closely when you start working on the injured.
- **Make three rounds:** Don't miss a serious injury. Walk with your helpers from one patient to the next, without taking more than 2 minutes for each patient on each round.

Round no. 1: Open airway and stop the bleeding

- Check the airway: Immediate head tilt and recovery position for those who need it. Leave one helper with victims with airway problems and tell him to shout for you if he finds it difficult to keep the airway open.
- Stop external bleeding if any: Instruct a bystander or helper to press on the proximal artery on the bleeding limb and to warm all victims.

Round no. 2: Start IV infusions and pain relief

- IV infusions: Don't waste time measuring the blood pressure. We use rough indicators when working in a mass-casualty accident: If an adult has cold limbs or a child has a cold nose-tip, set up one large-bore IV cannula and start flushing Ringer 2,000 mL as a start in an adult. Have one bystander squeeze the IV bag. If there are no bystanders to help you, put the IV bag under the patient to let his body weight squeeze the infusion through the IV line. (The IV bag and IV set must be completely free of air.) Cover and warm all victims.
- Pain relief: Give a single IV dose of ketamine (0.2-0.3 mg/kg) to all patients in obvious pain and to all "silent" patients.

Round no. 3: Find out who is "Patient no.1"

Take a break – tell people around you to keep quiet and not to disturb you. Then look again at all the injured: Sweep off dirt and blood, and look at all wounds. Ask yourself these questions:

– *Are there patients with injuries so serious that they will probably not survive, even with the best life support?* Leave these patients alone, don't spend time on them now.

–*Who is the patient with a serious injury, but not so serious that he will die?* We will call this patient "Patient no. 1".

Go for "Patient no. 1" now

- Secure an open airway: Suction and endotracheal intubation if necessary.
- Reassess the breathing: If the breathing improves after ketamine – good. If not, maybe he needs more ketamine. Or, there may be a chest or abdominal injury (insert chest tube? stomach tube?)
- Reassess the circulation: Gauze packing and compressive dressing for limb bleeding. What is the effect of the IV infusion, are the limbs warmer? Pass Ringer infusions rapidly until the systolic BP is 90 mm Hg.

Now "Patient no. 1" is ready for evacuation.

Again stop, get an overview to identify "Patient no. 2", the victim who is the second-most injured after the first. Reassess "Patient no. 2" – the airway, breathing, and circulation. Then do the same for "Patient no. 3", and so on.

Documentation. Start the evacuation

When all patients are as stable as you can get them, start the evacuation.

Documentation

The accident scene will be chaotic. Therefore it is especially important to fill in the Injury Charts for all the mass casualties. Register carefully for each patient the weapon history, the time of injury, the wounds you identified, RR-HR-BP-consciousness, and the treatment you gave.

See case story p. 124.

Transport

Give exact orders for the evacuation of each patient – the position, infusions, and drugs each should have during the transport. You yourself should follow the evacuation of the most seriously wounded victim.

Life support for mass casualties – in brief

Prepare yourself well. Treating mass casualties is a difficult task. You have to be extremely cool and concentrated.

Work systematically. Complete rounds no. 1 and 2 before you identify "Patient no. 1".

The injured child

Children do not react to injury the way adults do. In particular children are different in the way they react to blood loss. Yet the basic rules for examination and treatment are the same as in adults: First the airway, then the breathing, and then the blood circulation.

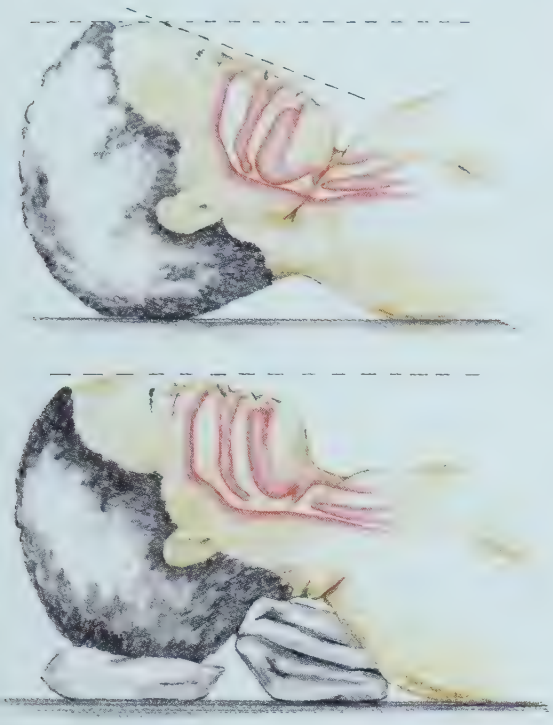
"The normal values" for children are different from those for adults. You must know what is normal when you examine an injured child.

Also see pocket folder at the back cover.

Normal values for children

Age	1-2 years	5-7 years	12 years
Breathing rate/ minute (RR)	Up to 40	Up to 30	Up to 20
Heart rate/ minute (HR)	Up to 160	Up to 140	Up to 120
Systolic blood pressure (BP)	More than 80	More than 90	More than 100
Approximate body weight (BW)	10 kg	20 kg	35 kg
Blood volume (mL/kg/BW)	90 mL/kg	80 mL/kg	80 mL/kg
Approximate blood volume	1,000 mL	1,500 mL	2,500 mL

There are individual differences depending on weight, nutrition, and diseases.



Head tilt to open the airway in children.

Airway control in children

Open nose!

Children breathe mainly through the nose. If the nose is blocked, they become desperate. So remember:

- Blood in the nose – remove it immediately with suction.
- Head bandage – the nose must be left free.
- Insert the stomach tube through the mouth.

Helping small children breathe

At the scene you will often find the chest-injured child in this typical position: He or she sits alone, pale, not crying, breathing rapidly through wide and quivering nostrils. That child needs immediate help to breathe better.

Traffic injured child, Cambodia 1999.

Be close to the victim

Injured children are always afraid. Fear affects the breathing. So, comfort the child and let it sit on its mother's or father's lap.

Use half-sitting position

Small children use the diaphragm to breathe. And the diaphragm works best if the injured child is sitting or half-sitting. Exception: place unconscious children in the recovery position.

Chest injuries: See p. 90.

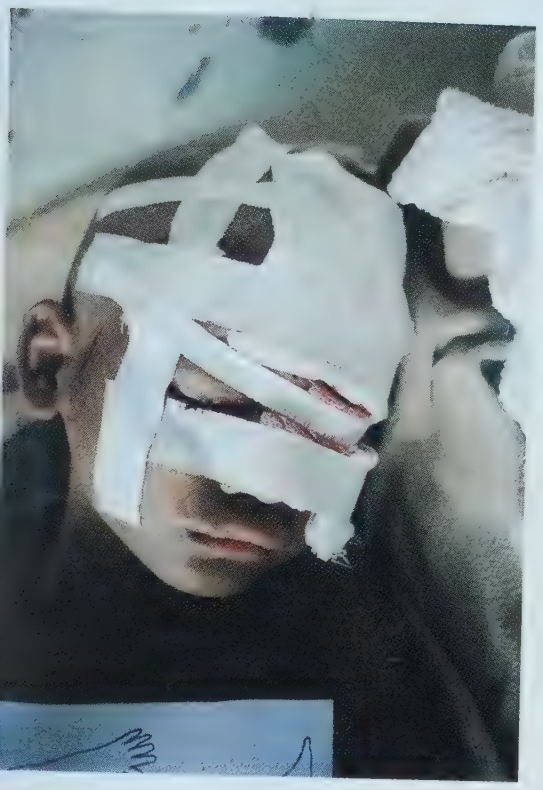
Insert stomach tube soon after an abdominal injury

Gases and intestinal fluid rapidly inflate the stomach in children after an abdominal injury. Crying also inflates the stomach. Don't hesitate to place a stomach tube (diameter 3 mm) through the mouth to deflate the stomach.

Stop the bleeding, keep them warm, give volume treatment

Children rapidly shut down the blood supply to skin and limbs when they bleed. It is usually easy to stop bleeding from limb wounds – use the same method as for adults.

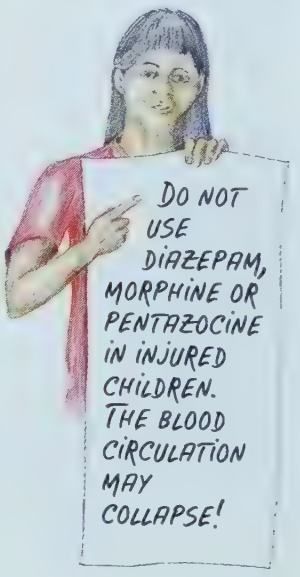
To stop the bleeding: See p. 50.



A good bandage – the nose is free.

Keep the child warm

Children quickly become cold. The younger they are, the less they can protect themselves. Remove wet clothes immediately. Warm the injured child, let it sit on a lap. Cover with dry clothes – also the head. Warm IV infusion or warm drinks is a must!



Look at the HR, not at the BP

Place an IV line quickly and start warm IV infusion if the HR is higher than normal. Children react to blood loss with increased heart rate and less blood supply to skin and limbs: BP can remain normal until half of the blood volume is lost. By the time the BP starts falling, the child is close to death.

IV cannulation

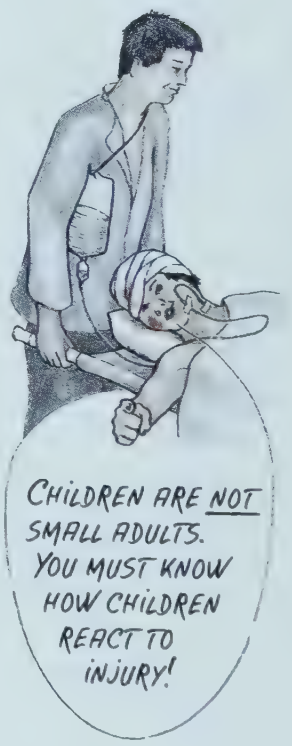
Limb veins in children collapse quickly. So place two IV lines before the arm veins collapse. If you can't do it, try cannulation of the external jugular vein. It is prominent in most children. If that fails, do a venous cut-down. Newborn and infants under 1 year often have prominent scalp veins that can be used.

Venous cut-down: See p. 99.

The IV volume therapy

Don't underestimate the blood loss. An injured child with a cold nose and increased HR may have already lost 1/3 of its blood volume. Start IV therapy immediately:

- Give warm Ringer 20 mL/kg body weight rapidly.
- Assess the response: Count HR, RR and feel the skin temperature. If it is still not normal:
- Give more warm Ringer, 10 mL/kg.
- Again reassess: If there is still no improvement, the child is probably bleeding inside. Examine the child again. You may have missed a chest or abdominal injury. Hurry to the hospital. Keep the child warm and give warm IV during the transport.



Child victims need food

Small children have very small stores of carbohydrate in the body. If the injury is serious and the hospital far off, they run out of blood glucose and collapse unless they get food. These are the means of nutrition:

- Breast milk or sweet fruit juice by mouth or by stomach tube.
- Or, glucose 500 mg/kg as slow IV infusion. The glucose can be mixed with the electrolyte infusion, or be given separately.

Or soups: See p. 183.

Basic life support to children – in brief

Let them sit or half-sit, then they can breathe better.
Warm the child and warm the IV infusions. Always start IV infusions before the BP comes down.
Child victims are scared – stay close to them at all times.

Burn victims

Explosions close to the face cause fragment wounds and burns. Look for airway burns too! Cambodia, 1998.

The burn injury is more than the burn wound itself. Burns start a series of complications in the whole body:

- Breathing hot air or toxic smoke damages airways.
- Large amounts of water and protein leak from the bloodstream, the blood circulation may collapse.
- Large burn wounds and loss of warm body fluids make the victim cold.
- The burn speeds up the body's chemistry. The need for energy is doubled with large burn wounds.
- Burns depress the immune system, there is high risk of infections.
- It is extremely frightening to suffer injury from domestic fire, explosions or arson. Burn victims are emotionally shocked.

Complications start immediately after the burn injury. Life support for major burn victims must start early and be intensive.

Don't miss the airway burn

There is high risk of airway damage if the victims have been lying inside a closed burning room or been close to an explosion. The signs of airway burn may be few for the first 12 hours. Then the airways gradually narrow due to internal swelling, and fluid fills up the lungs.

- **Look:** Burn wounds in the face and mouth, burnt eyelashes or black spit indicate damage to the airways.
- **Listen:** Coughing or wheezy breathing?
- **Count the breathing rate:** Unrest and high RR indicate burn injury to the lungs.

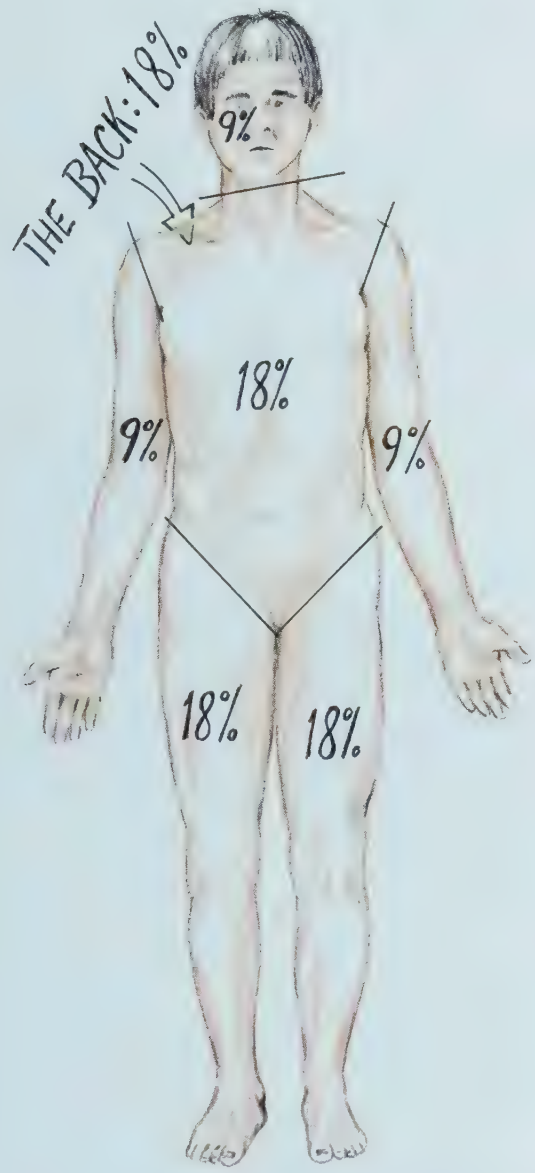
Support the breathing: See p. 48.

If signs of airway burn, take the victim to the hospital immediately. Transport in half-sitting position. Give pain relief. Be ready for endotracheal intubation. Examine the victim often.

Pain relief: See p. 60-63.

Volume treatment the first 24 hours

The loss of fluid from the circulation depends on the size of the skin burn. A burn that covers 20% or more of the total body surface area is a large burn. Victims with large burns lose a lot of fluids, especially the first 8 hours after the injury. Large burns must have intensive IV volume treatment as soon as possible.



The rule of 9: We divide the body in parts that are either 9% or 2 x 9%=18% of the total body surface area. To calculate the burn area: Include all areas where the skin is red, not only the areas with blisters.

First: Assess the size of the skin burn ("the rule of 9")

Then: Calculate how much IV fluid is needed
Give IV Ringer: 4 mL x kg body weight x skin burn area in % of total body surface area.

Half of the total 24 hours' volume should be given during the first 8 hours after the injury. The second half within the next 16 hours. Use warm fluids!

Fluids for IV and oral volume treatment: See p. 55 and 183.

Two examples of volume treatment

Woman of 50 kg with skin burns of the whole front of the chest, abdomen, and both legs. The accident had happened 4 hours earlier.

- Assess the burn area: 18% + 18% (only the front part of both legs) = 36%
- The total IV volume for 24 hours = 4 mL x 50 x 36 = 7,200 mL Ringer.
- Give 3,600 mL warmed Ringer within 4 hours, and 3,600 mL for the next 12 hours. She should pass urine. If not, give more.

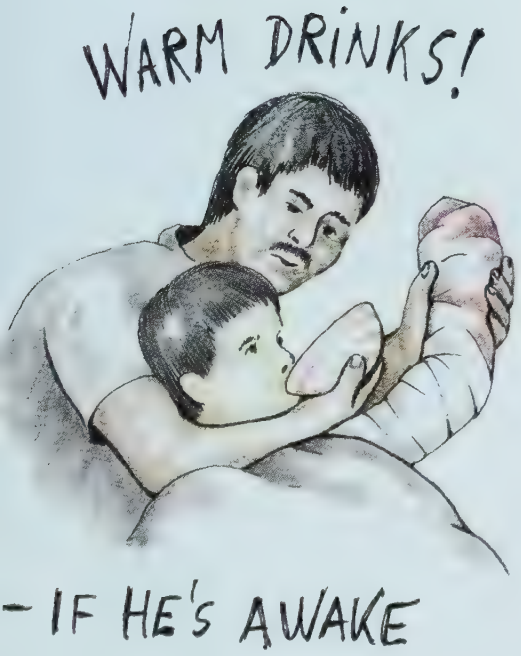
Large burns: Get IV cannulas in – even through burnt skin.

A six-year-old girl with skin burns of the front and the back of both arms. The accident had happened 12 hours earlier. Plan for the volume therapy:
IV volume for first 24 hours = 1,440 mL (burn area = 9 + 9 = 18%, estimated body weight 20 kg). She needs 720 mL warm fluids as soon as possible, and 720 mL more during the next 12 hours. If she is awake with no other injuries, give 1 liter of fluid now (soup with some salt), and another liter during the next 12 hours. Not all of the drink will be absorbed from the intestines into the bloodstream. Therefore, give more oral fluids than the IV volume calculated from the formula above.

Volume treatment from the second day

The loss of fluid decreases 24 hours after the burn injury. From the second day the need for IV Ringer = 2 mL x kg body weight x skin burn area in % of total body surface area. In practice: give so much volume treatment (IV or oral) that the victim can pass urine normally.

Good urine production = 1 mL per kg body weight per hour.



Warming and food

Cover the burn wound with several layers of clean cloth. This helps reduce loss of fluid and temperature. Cover the victim with blankets. Drinks, food, and IV infusions should be warm.

Methods of warming: See p. 56.

Victims with large burns need a lot of food from the first day after the injury. If the victim is awake and without injuries to the abdomen: give soup or porridge with high calorie content. **Note:** In victims with extensive burns, the intestines work slowly the first day after the injury. There is risk of pooling of food in the stomach, with vomiting. Give the drinks in small sips only. Increase the volume of the meals from the second day.

Antibiotics: See p. 65 and 178.

Life support for burn victims – in brief

Look for airway burn.
Assess the size of the skin burn and calculate IV volume needed.
Give some of the volume treatment as nutritious food.
Keep the victim warm – use thick padded dressings.
Give a lot of comfort and encouragement, do not leave the burn victim alone at any time.

Problems caused by diseases

Sick people have less resources to draw on if they get injured. There is risk of a breakdown in blood circulation and also a higher risk of wound infection.

The body's defenses against infection: See p. 64.

They did not ask for the land mines. Cambodia 1997.

Diseases and malnutrition go hand in hand.
The land mines have occupied fertile fields. The result is malnutrition and starvation. Villagers also cannot boil dirty water as collecting firewood is dangerous. Most mine-infested communities have seen repeated local wars that have broken water or sewage systems and destroyed roads. This lack of food, protein, and clean water allows viruses, bacteria, and parasites to multiply. Lack of communication and money prevent people from going to health care workers. As a result, people are often suffering from diseases **and** malnutrition by the time they step on a mine.

Malnutrition increases the risk of complications

- Anemia (lack of blood) can result from malnutrition and infection. It reduces the body's natural ability to fight infection.
- A lack of protein slows down blood clotting: Wounds bleed more.
- Low counts of blood platelets are common in someone who is malnourished. This also means that wounds bleed more.
- An imbalance in blood salts may cause heart failure.
- The body's defenses against infections are weakened: So the risk of wound infections increases.
- A lack of certain vitamins and minerals delays wound healing.

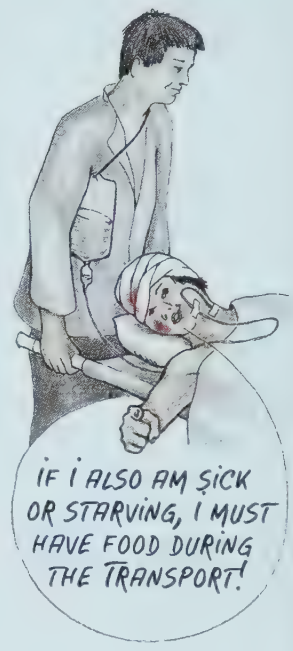
Blood platelets and blood clotting: See p. 30.

Several diseases are widespread in mine-infested countries, and cause particular problems. If some of those diseases are common in your area, learn to identify them so that you can prevent complications after injury.

Types of anemia

He needs food! Malnutrition causes complications. Angola 1997.

Anemia from malnutrition and starvation
Serious anemia means oxygen starvation, with a high risk of infection. It also increases the risk of heart failure and a breakdown in blood circulation after blood loss. Moderate chronic anemia (hemoglobin more than 8 g/mL) seldom causes problems. **Do this:** Be very careful to stop the bleeding. Give IV fluids rapidly until the heart rate comes down to normal. Keep the victim warm.



Thalassemia
This is a disease of the red blood cells which causes anemia. It is inherited (passed from parents to children at birth). It is common in East Asia, India, and the Middle East. After severe injuries, victims with thalassemia may have difficulty forming blood clots and bleed more than usual. **Do this:** Be very careful to stop all bleeding. Keep victims warm.

Sickle cell anemia
It is an inherited disease of the red blood cells, common in Central and West Africa. Patients have grave anemia. Oxygen starvation after severe injuries may cause "sickle cell crisis": The blood-clotting

Compare the color of the two palms: the patient has anemia.

system breaks down, and the patient starts bleeding seriously. At the same time multiple blood clots form inside the blood vessels. **Do this:** Stop the bleeding and give IV volume therapy immediately. Keep the victim warm! Never use tourniquets as they may provoke "sickle cell crisis".

Diseases with diarrhea

Amebiasis and other intestinal infections causing diarrhea are widespread in Third World countries. Diarrhea drains water from the body and reduces the amount of blood circulating through the body. A healthy person with injuries will withstand some blood loss. But even moderate blood loss is dangerous in a mine victim with severe diarrhea. **Do this:** Give more IV electrolytes than listed in the guidelines if the victim had diarrhea before the injury.

Guidelines for IV volume treatment: See p. 55 and pocket folder at the back cover.

Malaria

There are mine-infested areas where most people are infected with malaria. Patients with malaria may develop a "malaria crisis" immediately after a severe injury (or surgery): They get sudden fever, convulsions, unconsciousness, and the blood-clotting system breaks down.

Treatment for malaria: See p. 180-181.

Mother with child at a clinic nside the minefields. The girl as cerebral malaria. Cambodia 999.

HIV and AIDS

HIV is now common in most non-Muslim developing countries. HIV mainly affects the people in cities, but there are also mine-affected rural areas where HIV is common. Policemen and soldiers are often infected. There are two problems with HIV when managing an injury.

For the victim: His defenses against infection are permanently damaged. He is weak, and carries a high risk of wound infection. Give early and very intensive life support even after moderate injuries. Give IV antibiotics all the way to hospital (not one dose only).

For the medic: Blood and body fluids spread the HIV virus. You can become infected yourself if you are careless with cannulas and sharp instruments. And you may spread the virus from one patient to another unless you sterilize instruments properly.

- Always wear gloves while treating the injured patient! Never rush when using cannulas, scalpels, or scissors.
- Wash instruments well and boil for 20 minutes. This should kill the virus.

Cleaning and disinfection: See p. 106.

Diseases causing problems – in brief

Find out which diseases are common in your area, and learn how to identify them.
Early and intensive life support prevents most complications.

Transport to hospital

A 12-year-old girl is injured by a fragmentation mine. She has two injuries: a fragment wound to the chest, and a below-knee amputation. You have stopped the limb bleeding by compression of the artery, gauze packing, and compressive dressing. One infusion of warmed IV fluid is running. She has difficulties in breathing and probably has a hemothorax, but you have not been trained to place a chest tube drain. The hospital is 10 hours away. How would you do the transport?

Also study case stories on p. 112, 116, and 122.

Check before you go

Good life support during the transport. Kurdistan 1998.

The airway: Is everything done?

- Open airway? Anything to clean out of the mouth or the nose?
- Awake? She is awake now, but may be weak and vomit if she loses more blood. If so, place her in the recovery position.

The breathing: Is everything done?

- Good position? Let her be half-sitting if she is awake and has not vomited. Can she sit in her father's or mother's lap?
- Breathing rate? 30/min is too rapid, she is in pain. Give a dose of ketamine, 5-10 mg IV. She needs frequent small ketamine doses all the way to hospital.
- Is she bleeding inside? Place your ear to the chest: the breathing sounds are weaker at the side with the inlet wound. Probably she is bleeding inside the chest. If you cannot place a chest tube, you can warm the patient. This helps the body to stop the bleeding.

The circulation: Is everything done?

- Skin temperature, heart rate and blood pressure? Her nose is warm, HR 110/minute, BP 110 mm Hg. She has got 2,000 mL Ringer IV already, and she just passed urine. You have probably balanced the blood loss so far. But bleeding from the chest injury will continue – maybe for 10 hours, so let the IV drip run slowly.
- Bleeding from the limb wound? No bleeding through dressings.
- The IV lines? She has only one IV line. Place another IV cannula, and suture both of them to the skin, to be safe.

Anything more to be done for her?

- Missed any injuries? Check the face and eyes, the back, the groin, and the limbs again.
- Antibiotics? Yes, she has a chest injury and should have one high IV dose of ampicillin.
- Nutrition? It is already 4 hours since the injury and 10 hours more to the hospital. She definitely needs nutrition. There is no injury to the abdomen and she is awake. Give her cups of warm soup at intervals during the transport.
- Comfort and encouragement: She must not go alone. Ask her mother, father or a relative to follow her. Talk to the girl: *It is a long way to go, but you can make it, be strong! Tell us if you are cold or have pain. We will support you and we will cooperate, then we can make it together.*

Checklist (transport of one patient)

Torch or headlight.
Suction apparatus and catheters.
Ketamine for one IV dose every 30 minutes.
Atropine injection, 1 mL.
Adrenaline injection, 1 mL.
Antibiotics if evacuation takes more than 8 hours.
Syringes and needles.
Dry gauze and 5 rolls of elastic bandage.
Ringer infusion, 6 liters for 8-12 hours' evacuation.
Blankets.
Thermos or plastic bottles with hot water for warming the victim and the IV fluids.
Food if transport takes more than 8 hours.
Injury Chart and pen.
Your medic certificate and ID card.
Money for gasoline (and checkpoints).

Prepare the transport – think ahead

You yourself are responsible for the transport to be as convenient as possible. Be it car or hammock, she must be in a half-sitting position with one leg elevated. This patient's condition is unstable, so expect problems during the evacuation. You must follow her yourself, but you need at least one helper.

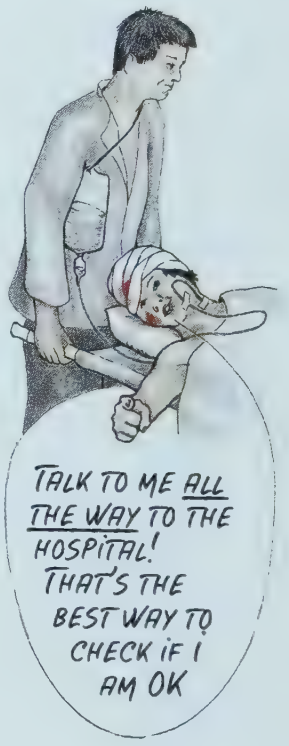
How many hours? How much equipment?

How many hours to reach the hospital? Are there possible delays due to poor weather, roads, car breakdown, military checkpoints, fighting? Take your time to calculate how much medical equipment and nutrition you will need. See the checklist.

During the transport: Check every 30 minutes

Airway

Talk to her. If she talks, her airway is open. If she turns confused and drowsy, suspect oxygen starvation – intensify the life support. In case she vomits, immediately place her in the recovery position. Have the suction apparatus and catheters ready and at hand at all times.



Breathing

Count the breathing rate every 30 minutes and make a note on the Injury Chart. She needs IV ketamine 5-10 mg approximately every 30 minutes.

Circulation

- Check skin temperature, HR, BP, and the limb dressing every 30 minutes, and note them in the Injury Chart. Set the IV infusion so that the skin is warm, HR around 100, BP around 90, and she is passing urine at intervals.
- Stop at village roadsides to warm infusions, to get bottles with warm water to place under the blankets, and to get warm drinks and food both for the girl, for you, and the helpers.
- Stop immediately if the amputation wound starts bleeding. Apply pressure on the femoral artery, and wrap another elastic bandage outside the one she has. If necessary compress the femoral artery all the way to the hospital.

Transport to hospital – in brief

Ask yourself before you start: Is everything done?

Always take your time to
- stop and intensify the life support if the victim becomes weaker
- check patient and take exact notes every 30 minutes
- stop at village roadside for nutrition and warming
- stop to apply extra dressing and pressure on the artery immediately if the amputation wound starts bleeding.

Medical documentation

Medics discussing Injury Charts. Cambodia 1999.

Medical documentation means collecting important information about the victim, the injury, the treatment, and the results. All health workers are required to record what they do. The **Field Injury Chart** (see below) is one example of how important information can be registered. The chart should be with the patient at all times during the transport to hospital.

Medical documentation is important for two reasons:

- **To treat:** The hospital staff needs to know the condition of the victim before he got to the hospital, and the medical treatment he had along the way.
- **To learn:** Without records of what we found and what we did, we cannot recall important details when we want to re-examine the case.

A Field Injury Chart and a Hospital Injury Chart are given at the back of this book. Copy them or modify them if you like.

Field injury chart Page 1

The patient

Name of medic/nurse/doctor: SOEUT+Rattana Name of clinic: SDAU
Name of patient: ROK HANG Sex: ☒M ☐F
From which village: ANDEK HEP Age: 35
Name of patient's father:

The weapon

Where did it happen: IN WOODS AT ANDEK HEP When did the injury happen: 15/9/97
Which type of mine (or other weapon): PMN MINE
How far was the patient from the explosion (meter): STEP ON IT 5:00AM
Name other persons injured in the same accident: (NO, BUT DONKEY DIED)

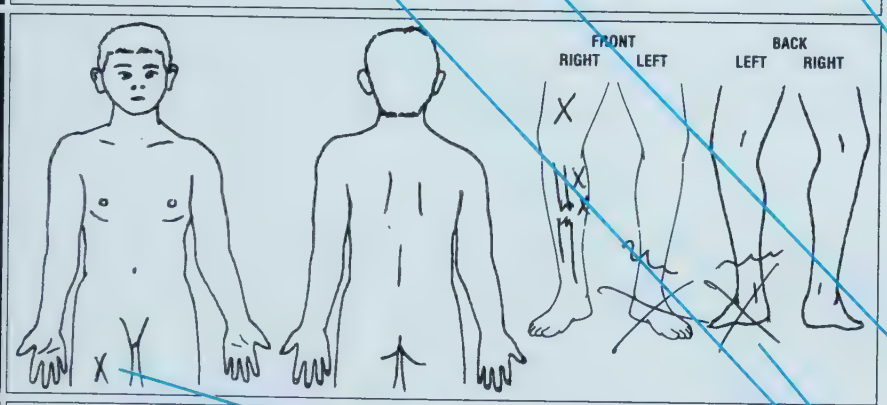
First help

Did first helpers treat the patient: ☒YES ☐NO How many first helpers: 2 When did first help start: 15/9/97
What kind of first help: ☐Open airway ☒Stop bleeding ☐Keep warm ☒Position 5:30AM
Other firsthelp:
How was the patient transported from the site of accident: ☐On foot ☒Hammock ☐Donkey ☐Bicycle ☐Taxi ☐Ambulance ☐Other:

Describe the injury

Did the patient come with tourniquet on: ☐YES ☒NO When was tourniquet placed:
Type of tourniquet: ☐Rope ☐String ☐Clothes ☐Tree branch ☐Other:
Describe the main injury: AMPUTATION LEFT LEG
FRACTURE + DEEP WOUNDS RIGHT LEG
Describe the other injuries:

Draw all injuries



Before treatment

	4 points	3 points	2 points	1 points	0 points	Sum	When was this examination done:
Breaths per minute	10–24	25–35	more than 35	less than 10	no breathing	8	15/9/97
Systolic blood pressure	more than 90	70–90	50–69	less than 50	no pulse		8:30AM
Mental response	normal	confused	to sound	only to pain	no response		

Rectal temperature before treatment: °C time:

AK Grafisk

Fill in the chart there and then. The Field Injury Chart is filled in by the mine medic as he examines, treats, and transports the victim to the hospital.

The weapon history: The hospital needs to know the type of mine and how far away the victim was from the explosion.

Delay after the injury: The risk of wound infection increases rapidly if the patient is not operated on 8-10 hours after the injury. The hospital staff should know how much time has passed since the injury.

Did a village first helper help the patient? You need this information to determine the effect of the training given to village first helpers.

Village first helper assistance: See p. 36 and p. 168-171.

Tourniquet? If the victim had the tourniquet for several hours, fasciotomy should be done – either by the medic or at the hospital.

List all injuries: Mark all wounds on the drawing.

Calculate the Severity Score. Measure and record three things: (1) The breathing rate. (2) The systolic blood pressure. (3) The mental state of the victim: Is he confused or drowsy? Is he unconscious, but responds when you talk to him? Is he unconscious and responds only when you pinch his skin? Or is there no response at all? 4 points is the best score, 0 points the worst score. Calculate the Severity Score by adding up the points for RR, BP, and the mental state.

Severity scoring in children: See p. 191.

Also see Rok Hang's Hospital chart on p. 172.

A total of 12 points means that the victim is in a good condition. Scoring 9 points or less means that the victim is critically injured.

Life Support done in-field Page 2

15/9/97 AM — Hours/Days after the injury: 8:30 | 9:00 | 9:30 | 10:00 | 10:30 | 11:00

Airway
- Head tilt, chin lift: AIRWAY OK
- Cleaning of airways
- Suction of airways
- Position of patient (draw)
- Intubation of airways
- Other

Breathing
- Mouth-to-mouth
- Bag/mask-to-mouth
- Stomach tube
- Chest tube

Circulation
- To stop bleeding (describe): PACK + PRESSURE DRESSING BOTH LEGS; SPLINT RIGHT LEG
- Blankets, other cover: SLEEPING BAG
- Warming from outside: BUDDY WARMING (WIFE)
- Warm IV fluids: 2 L WARM RINGER
- Other warming (describe)
- IV lines – how many: 2
- IV lines – where: ARMS
- IV electrolyte (ml): 3000 1000
- IV colloid (ml)
- Fasciotomies: X LEFT LEG BELOW KNEE (KETAMINE ANESTH)
- Other surgery: NO

Drugs
- mg ketamine IV: 10 (70) 10 10 20 10
- mg pentazocine IV
- other pain relief
- Antibiotics: PCL 8 MEGA IV
- Other drugs: X ATROPINE 1MG IV; X DIAZEPAM 2.5 MG IV

Transport
- Type of transport: PICKUP CAR
- Who follows the patient: WIFE + SCOUT
- Problems during transport: (BAD ROAD)
- Time of hospital arrival: 11:20
- Dead before hospital – when?

At hospital admission

	4 points	3 points	2 points	1 points	0 points	Sum	When was this examination done:
Breaths per minute	10–24	25–35	more than 35	less than 10	no breathing	11	15/9/97
Systolic blood pressure	more than 90	70–90	50–69	less than 50	no pulse		11:20 AM
Mental response	normal	confused	to sound	only to pain	no response		

Rectal temperature before treatment: °C time:

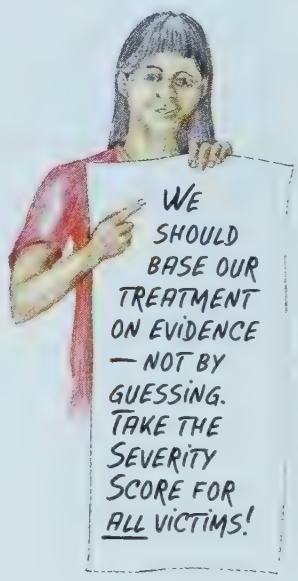
AK Grafisk

Register the treatment: Write down all treatment done in the field, and the time it was given. For example, if a victim is confused and drowsy on admission to hospital, it may be because he had ketamine and diazepam during transport. Or if he was not given any drugs, he may have severe oxygen starvation. This example shows that written information on all treatment given in the field is very important to the hospital staff.

Position and warming are also part of the treatment, and should be registered.

Write down problems you had. A few words are enough.

The Severity Score is registered twice: Once, when the medic examines the victim for the first time, before starting to treat him – that is on p.1 of the Injury Chart. **And again,** when the victim arrives at the surgical hospital – on p. 2 of the Injury Chart. Remember to mark the exact time for both the first and the last Severity Score. You can find out if the victim becomes worse or better by comparing the two scores. In this case the victim became better – a score of 8 three hours after injury rose to a score of 11 on hospital admission.



Do research to treat better

We need to improve our treatment regularly to get better results for the injured. The Injury Chart with the Severity Score is a useful tool to find better ways to treat mine victims. We should also compare the injury and the treatment with the results. For this you need a **Hospital Injury Chart** where the outcome of the hospital treatment is registered: How many died? How many had wound infections? How many IV units of blood did the victims get?

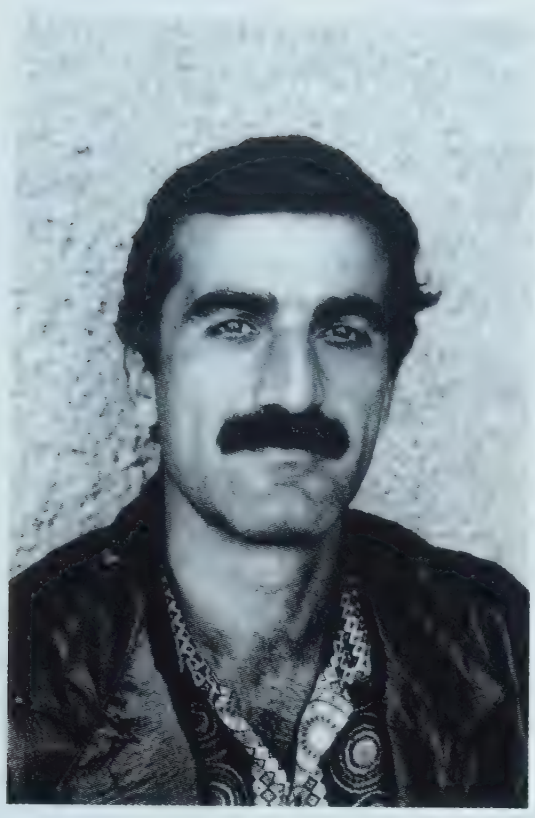
More on quality control and research: see p. 172 and 192-197.

Documentation in the field – in brief

Important information from the field will not reach the hospital unless we write it down carefully and exactly.

We cannot learn from mistakes without exact documentation. We cannot improve the quality of our work without learning from mistakes.

Take care of yourself and your helpers



Bebak is a medic in Kurdistan. He has helped lots of mine and war victims.

It's hard to be a mine medic. All first helpers suffer from painful emotions after violent experiences such as a mine accident. As time and accidents pass by, these painful experiences build up in our memories and become a burden. But it need not be so if we were to sit down together after the accidents to talk with each other: *What happened? How well did we do? What did we feel? Do you have nightmares now?* This helps us unload our painful feelings. It will enable us to go on for years with our difficult job.

The problem with painful memories

At the scene of an accident you concentrate hard to use your knowledge, hands and equipment. You have a job to do, and cannot afford to panic. Still, the adrenaline reactions can be felt strongly as you work. Your hands become clammy and shaky, your body feels numb, and you feel your own strong heartbeats – even if you don't notice any strong emotions. Yet the feelings are there, deep inside you.

See case stories on p. 116 and 124.

The emotional reactions comes later

Painful memories can trouble your soul. Images of the wounded, the sick feeling you get when you moved a torn arm or touched an amputated leg, the strong smells, and the screams – all these memories will keep coming back long after the action is over and the victims transported to hospital. Even years after the accident those memories may suddenly come back to you. You may wake up, sweating from nightmares – you have been there again, at the scene. The good and committed first helper often gets strong emotional reactions after an accident, such as anxiety, guilt, and bad temper. To talk about your feelings may prevent these negative reactions.

Medics during training. Karen State, Burma, 1993.

At the accident

- Try to get as much information as you can when you are called to an accident: How many are injured? Any children? Anyone you know? This information will help you to prepare your heart and mind and help you reduce your own stress.
- Always have your equipment ready and well organized. This will also reduce stress and frustration as you work.
- Be friendly with the others who try to help. A good leader will give clear instructions and help everyone to find their place in the rescue work.

More on how to prepare yourself: See p. 40.

After the accident

After the victim has been taken to hospital, you should take time to care for yourself and the other helpers.

Prepare a meeting

Make sure to invite everyone who helped at the scene and during the evacuation. Find a place where you can sit in a group without being disturbed. Plan to spend at least one hour together. Prepare some tea or fruits for the participants.

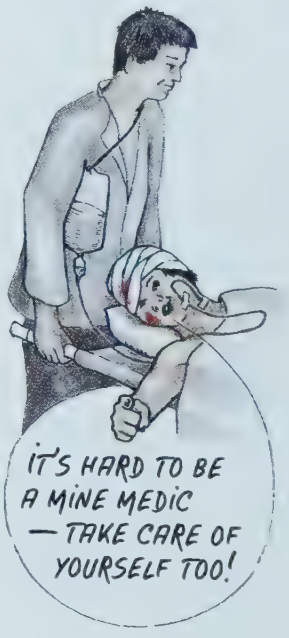
How to run the meeting

- Present yourself and the purpose of the meeting. Give facts and updated information on the accident: How are the victims now? How many were killed? Where are the victims and their families?
- Explain the purpose of the meeting: to talk about the helpers' own thoughts and feelings – not to discuss medical and technical matters.
- Make a round of the members to let everyone present himself. Make clear that everyone should feel confident to speak freely – that nobody in the group is to talk to others outside the group about what is expressed at this sit-in.

Let everyone talk

- Let each one tell his or her story: What did you do? What did you see, hear, smell, and think? What did you feel? Listen carefully to each one's story and encourage one another.
- People are different: some will easily show a lot of feelings, some will be quiet and shy. Don't be afraid if someone cries, shows anger, remorse or guilt. Remember: There is no such thing as having "correct" or "wrong" feelings. Carefully ask those who are still silent to talk about their own reactions to what the others have said.
- Laugh and use humor. Try to lighten up the meeting if you can.

Support each other. Medics in Kurdistan, 1998.



What is normal, and what can we expect for the future?

- Helpers share many of the same feelings after an accident.
- Memories can be painful and disturbing enough to affect a helper's sleep, appetite and sex life.
- Talking about the experience is the best way for helpers to unload stress and painful emotions. For most helpers, the reactions will decrease gradually over time.
- The helpers can help one another to recover: Maybe the group wants to meet again soon?

Take care of yourself – in brief

Call all helpers for a group meeting as soon as possible after all major accidents.
Let the group talk freely about their thoughts and emotions connected to the accident.
Assure one another: It takes time to recover from painful emotions.

Points to note – Section 3

Yellow pages = Warning!
If you are a first helper or a student in simple life support: the yellow pages are not for you. In the yellow section we discuss advanced procedures. You need special training, equipment, and permission to practice these procedures.

First is simple life support
Most victims will be well off with simple life support only. But some chest-injured patients need a chest drain to survive. And some mine amputees need someone to do fasciotomy in the field to save what is left of the limb. But note that we give simple life support to all victims first. Only when we see that the simple treatment is not enough, do we go on to give advanced life support.

We have to break some traditions
Severely wounded victims start dying at the time of injury, and can only survive if they get early advanced life support. In the minefields, war zones, and natural disasters of the Third World where are the doctors and the surgeons? They are not there, they are hours and days away. That is why we have to take advanced life support and some life-saving surgery from the big-city hospitals out to the district hospitals and minefields. But by doing so, we are breaking a medical tradition of restricting advanced medical skills to big hospitals. We should have reasons and caution for breaking with such traditions. And we do have strong arguments: advanced life support outside hospital saves lives and limbs, and we can document that it works (see p. 12). Being cautious means having good training and proper equipment: that is your responsibility.

Certification is necessary
Advanced life support done in the wrong way can kill the wounded. No one should be allowed to give advanced life support unless they already have months of practice in simple life support, and are training in the advanced life support on animals, and can prove in practical tests and refresher courses that they have the necessary skills. Certificates should then be issued to them in cooperation with the surgical hospital and local health authorities.

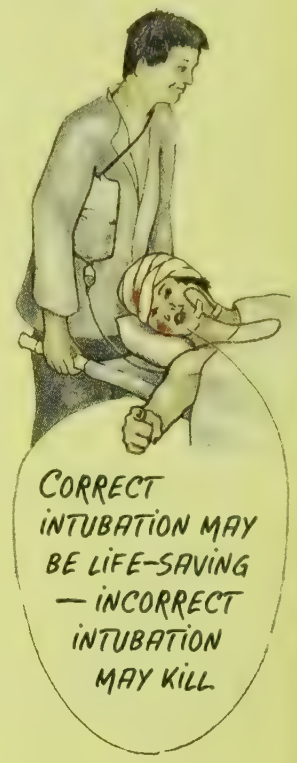
Section 3:
Advanced life support

Endotracheal intubation

Passing a soft plastic tube into the trachea (wind-pipe) is called endotracheal intubation. When a person is unconscious he may not be able to stop his airway from becoming blocked by vomit, blood, or the tongue. Endotracheal intubation solves that problem.

Ibrahim drowned in the river

It was springtime and the river was swollen with melted snow. Ibrahim (14 years) and his friends were playing football near the bank. When the ball was kicked into the river, Ibrahim went for it but the currents took him. When they found him 50 m downstream, he was floating face down in the water. His friend shouted: *Place him in the recovery position and send for medic Rahim!* The boys had attended Rahim's training course in first aid at school, so they knew what to do. They checked if Ibrahim was breathing – he was not. They checked the carotic pulse – there was no pulse. They were doing CPR when medic Rahim arrived a few minutes later. Rahim quickly assessed Ibrahim: No breathing, the mouth filled with water. No pulse. *I'll have to intubate him, or else all this water will get into his lungs,* Rahim said. *Go on with CPR, boys, while I get ready.* Rahim found the equipment in his bag: suction, laryngoscope, tube with stylet and syringe, gauze for tying the tube, stethoscope. *Now stop CPR,* he instructed. *Be ready with the suction, and give me the tube when I need it.* Rahim had no problems in passing the tube down the airway. He blew air into the tube and could hear air enter both lungs, so the tube was in correct position. He tied the tube carefully. Now they continued CPR using bag-to-tube rescue breathing and gave 1 mg adrenaline IV. When Ibrahim started breathing and began to fight the endotracheal tube, Rahim removed it. Ibrahim was alive.



More case stories: See p. 46, 88, and 116.

The equipment must be ready

Laryngoscope (check that it works).
Endotracheal tubes in correct sizes (see table), stylet, syringe, ribbon gauze.
Suction apparatus and suction catheter.
Stethoscope.
Self-inflating bag (you can also give rescue breathing mouth-to-tube).

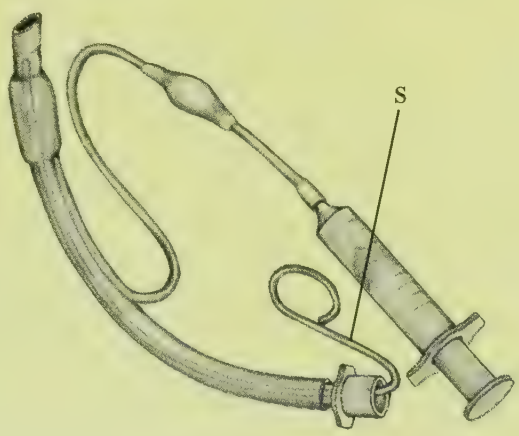
Endotracheal tube size

Age of victim	Diameter (mm)
Newborn	3.0
1-3 years	5.0
5-7 years	6.0
12 years	7.0
Adult (small)	7.0
Adult (big)	8.0

Rough guide: Tube as big as the victim's 5th finger.

Who needs endotracheal intubation?

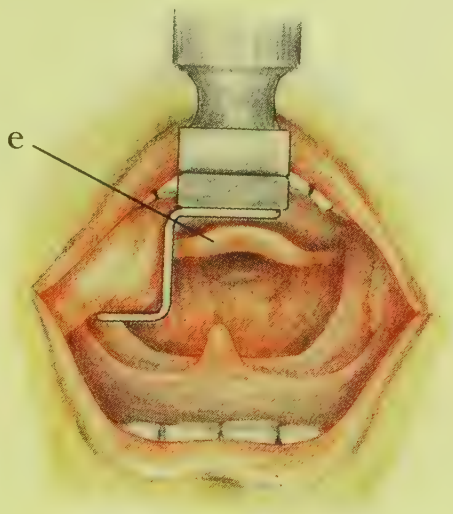
Intubation should be done on victims who are unconscious, or so weak that they cannot talk – especially
- if the victim does not breathe or breathes poorly
- or if blood is pouring into the airway from large wounds on the face
- or if the hospital is far away.



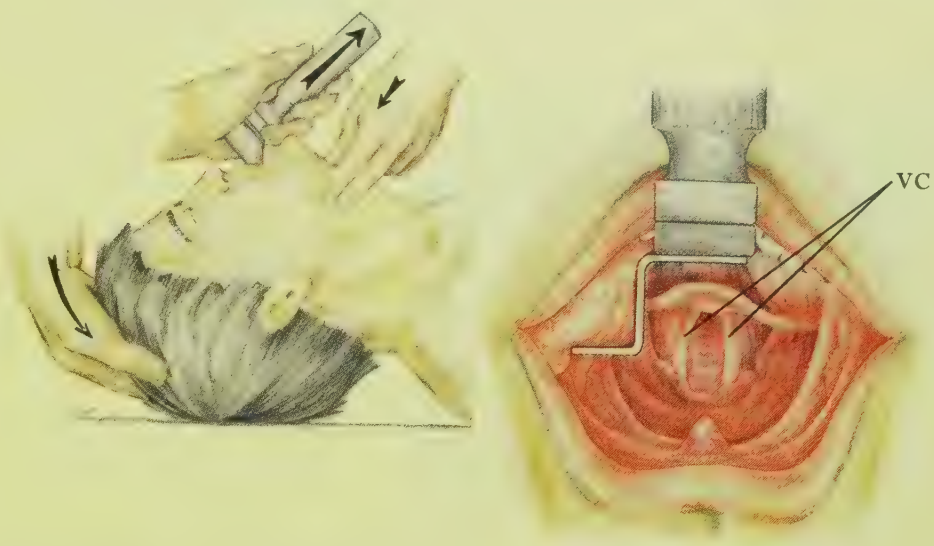
Place tip of stylet (s) 2 cm from tube end, and bend upper part of stylet so it doesn't slip down. Note: The stylet inside the tube should be slightly curved.

Place victim flat on his back. Tilt head backward. Give two minutes rescue breathing before intubating. Have a helper ready for cricoid pressure (see p. 47).

Hold laryngoscope in left hand, slide it into right side of victim's mouth.



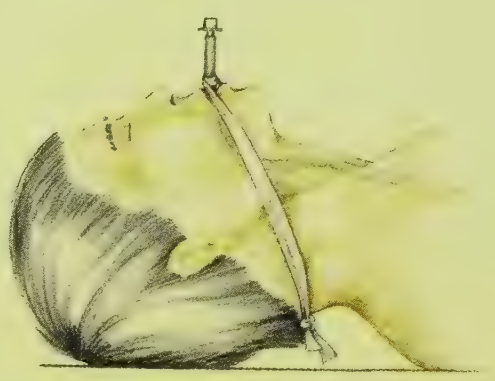
Lift base of the tongue, and forward laryngoscope until you can see epiglottis (e).



Now **lift** laryngoscope in direction of the handle – **do not bend it toward yourself.** You can now see the vocal cords (vc). If not, push cricoid upward and to the right.

ou **must** see the vocal cords! lide tube past the cords and re- ove stylet. Advance tube well elow cords (in adults: 24 cm arking at victim's lips). Hold be steady and inflate cuff.

If victim is breathing by himself: Check that warm breaths are coming by the tube, also check that breathing sounds are equally strong over both lungs. If the victim does not breathe: Blow air in the tube, listen to breathing sounds and see that both sides of the chest rise. The abdomen should **not** rise. If you suspect tube in esophagus, remove it immediately.

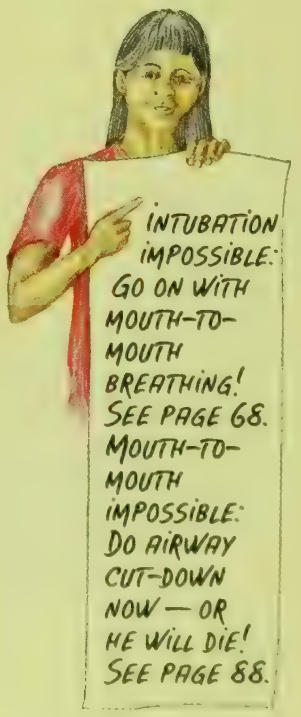


Fix the tube with gauze bands. Tie properly, tube displacement may kill. After tying, check tube position again. If breathing becomes difficult or victim becomes pale, withdraw the tube 2 cm and check breathing sounds again.

victim does not breathe mself: Attach self-inflating g and start assisted breathing mediately, approximately breaths per minute. ithout bag: Start mouth-to- e rescue breathing.

Failed intubation:

- Give 2 minutes of rescue breathing before you try again. No attempt should last more than 30 seconds.
- Before trying again: Elevate the head a little. Tell the helper to push the cricoid upward and to the right. Use a smaller tube, bend the stylet more. Not more than 3 attempts – edema and bleeding may kill the victim.
- If the victim vomits: Place in recovery position immediately. Clean the airway with suction. Then place him flat on his back with cricoid pressure, and try intubation again.



Endotracheal intubation – in brief

Intubation gives safe airway – but can be difficult or impossible. Nobody should try intubation without having trained to do it at regular intervals.

Airway cut-down

Airway cut-down saved the life of this farmer. His larynx became blocked by acute infection and intubation was not possible. Cambodia 1998.

Airway cut-down (crico-thyrotomy or emergency tracheotomy) is cutting a hole through the skin and the larynx in order to place an endotracheal tube. An airway cut-down is only done when standard endotracheal intubation is not possible.

Endotracheal intubation: See p. 86.

Drowning in his own blood

Jose Costa is an experienced Angolan mine clearer. He had identified a Type 72 small blast mine (greetings from South Africa!) and was carefully digging sand off the mine with his knife. The other team members and medic Neto sat in the shadow of a tree 50 meters away, waiting for Jose to finish what was normally a simple job. Somebody had told them that the 72s could have anti-tilting devices to make them explode when the mine was tilted more than 20 degrees. These anti-tilt mines were clearly designed to kill the mine clearers, but so far they had seen none of those "smart" devils here in Moxico. Not until today, that is. The 72 went off when Jose carefully removed it from the ground. Neto saw how the blast lifted Jose off the ground. He grabbed his medical kit, rushed to him and turned him to the side. It looked as if the lower part of his face had been blown off. He was unconscious, but still breathing. Blood bubbled from his torn mouth. Then Jose coughed out lots of blood. *He will drown in his own blood,* Neto said. *I must intubate him.* He introduced the laryngoscope and told one of the other mine clearers to push the pedal suction. But despite suction it was impossible to see the vocal cords. Desperately Neto tried to clear the blood from the pharynx using a gauze swab. Then Jose vomited – and stopped breathing. *He is dying!* the other mine clearer shouted. *Do something!* Neto did an airway cut-down, inserted an endotracheal tube through the cut-down incision, and started mouth-to-tube rescue breathing. It saved Jose's life.

Also see case story p. 116

The cut-down

When?

If the upper airway is blocked or partly blocked AND you cannot pass the endotracheal tube with the laryngoscope – do an airway cut-down **immediately.** Remember, after 4-5 minutes without oxygen the patient's brain is damaged. With the victim lying flat on his back, extend the neck by tilting the head. Or let the head hang over the edge of a table. Or put a roll of clothes under the victim, between his shoulders.

When to do endotracheal intubation: See p. 86.

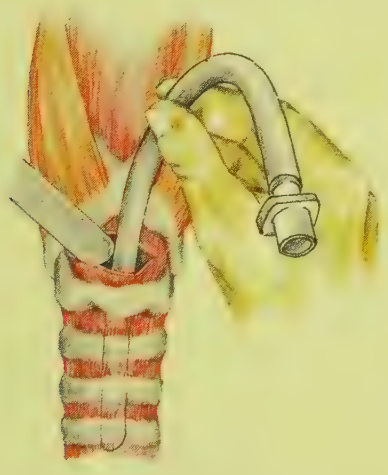
Finding the crico-thyroid membrane.

Find the crico-thyroid membrane

The cut-down is done through the membrane between the two main cartilages of the larynx (the thyroid cartilage and the cricoid cartilage) called the crico-thyroid membrane. First identify the cricoid cartilage (c): Find the top of the chest bone in the mid line. Let your finger run up the trachea exactly along the mid line. The first "peak" of cartilage you encounter is the cricoid. Then let your finger run further upward along the mid line: Now you feel another, larger "peak" of cartilage, that's the thyroid (t). The crico-thyroid membrane is the narrow "hollow" you feel between the cricoid and the thyroid.

ix the larynx and with one and cut through the skin.

ut through the membrane.



sert the tube.

ining in airway cut-down. en State, Burma, 1992.

Fix the larynx and cut through the skin

If you stretch the skin over the larynx to the sides, then the incision will bleed less. Maintain your left-hand grip on the larynx all the time until you have cut through the membrane with your right hand. The patient is close to dying, there is no time for anesthesia or disinfection. Use any sharp knife at hand. Cut through the skin and the subcutaneous fat exactly along the mid line from the peak of the thyroid downward a few cm.

Cut through the membrane

Wipe the soft tissues off the larynx with some cloth and use your fingertip to locate the crico-thyroid membrane. The membrane is just 0.5 cm to 1 cm beneath the skin. When you can see the membrane, make a decisive cut transversely through the membrane with the knife. This cut should not be more than 2 cm (one good fingertip) wide. Now you have entered the trachea and can hear air wheezing through the incision. Congratulations, you have saved a life!

Insert a tube if you have one

Place one small fingertip or the handle of your scalpel knife inside the cut-down incision to keep it open. Then introduce a 5-mm endotracheal tube through the incision into the trachea, fix the tube with your hand and inflate the tube cuff. If you have no endotracheal tube, use any soft plastic tube about 5 mm in diameter. Or simply hold the cut-down incision open with your fingertip until a tube is found.

Don't insert the tube more than 5 cm into the trachea.

If the victim does not breathe: Start rescue breathing – by either mouth-to-tube or bag-to-tube.

If the victim breathes: Clear the upper airways with suction. Pack wounds of the mouth and pharynx with gauze to stop the bleeding. Fix the tube with a band of gauze or cloth tied around the neck of the patient. Close the skin with interrupted sutures if you find time for it. The sutures should be deep and include the soft tissues under the skin, but do not suture the crico-thyroid membrane or the cartilage. If you cannot suture the incision, cover it with some clean gauze or cloth.

Rescue breathing: See p. 68.

Emergency airway in children

In children under 3 years, airway cut-down is difficult to perform without training and practice. Insert three large-bore IV catheters through the crico-thyroid membrane. This will give the child a sufficient airway in an emergency.

Airway cut-down – in brief

This is not done instead of intubation. Do cut-down only if you are well trained in intubation, and have tried to do intubation – and found it impossible.

Airway cut-down is simple provided you have practiced it on animals.

Training for airway cut-down: See p. 154 and 161.

Place chest tube at an early stage in children. Pooling of blood or air on one side will compress the other lung as well. Look for critical signs (arrows):

- Anxiety in her eyes
- Wide nostrils
- Retractions over the clavicles and the upper abdomen when breathing.

How to place chest tube drain

A mine fragment can injure the chest wall so that blood or air collects inside the chest cavity and makes the lung collapse. When you insert a plastic tube through the chest wall and drain out the blood and the air, the lung expands against the chest wall. This will stop the bleeding.

See case story p. 122.

Reasons to use chest drain

It stops bleeding inside the chest. The bleeding normally comes from rib arteries. When blood and air are drained out by the tube, the collapsed lung will expand if the victim breathes deeply. When the lung is fully expanded and presses against the chest wall, the bleeding points are sealed off – and bleeding stops.

Study the anatomy: See p. 211 and 212.

It improves the breathing. The lung collapses when blood and air collect inside the chest cavity. The victim is breathing with the other lung only, but the breathing is poor and rapid. It is urgent to inflate the collapsed lung. That can only be done by a chest tube drain.

To assess breathing problems: See p. 48.

It prevents "stiff lung". If blood is not drained, it clots and forms scar tissue. Non-elastic scar tissue attached to the lung makes the lung stiff.

It prevents chest infection. All fragment wounds are dirty and full of bacteria – so are chest wounds. Blood collecting inside the chest is excellent food for bacteria. An abscess will form unless the blood is drained.

The examination

Are the lungs injured? Count RR and compare breathing sounds to find out.

Find the wound in the chest wall

Undress the patient completely, wash off blood and dirt. The wound may be tiny – yet it may be life threatening. Also check the victim's back.

Compare breathing sounds

The injured lung is partially collapsed, so the breathing sounds are weaker over this side of the chest. Use stethoscope or place your ear at the chest wall and compare the breathing sounds over both lungs.

If in doubt: Puncture with needle

Insert a large-bore needle (IM size) through the chest wall in the area where you think there are weak breathing sounds. Let the needle slide through the chest wall at the upper edge of a rib in order not to hit a rib artery. One of two things may happen: If air wheezes through the needle when you enter the chest cavity, you probably hit the pneumothorax – insert a chest tube. Or, if you can draw blood through the needle into the syringe, you probably hit the hemothorax: Insert a chest tube.

If you are still not sure if there is blood or air inside the chest – but the victim has a chest wound and breathes poorly – or there is a chest wound and signs of blood loss:

Place a chest tube!

Equipment you need

Soap and clean water.
Soft plastic tube 10-12 mm wide.
Knife.
2 pairs of large artery forceps.
Sutures (large curved cutting needles) or adhesive tape.
Suction apparatus or a bottle with soap solution (see p. 92).

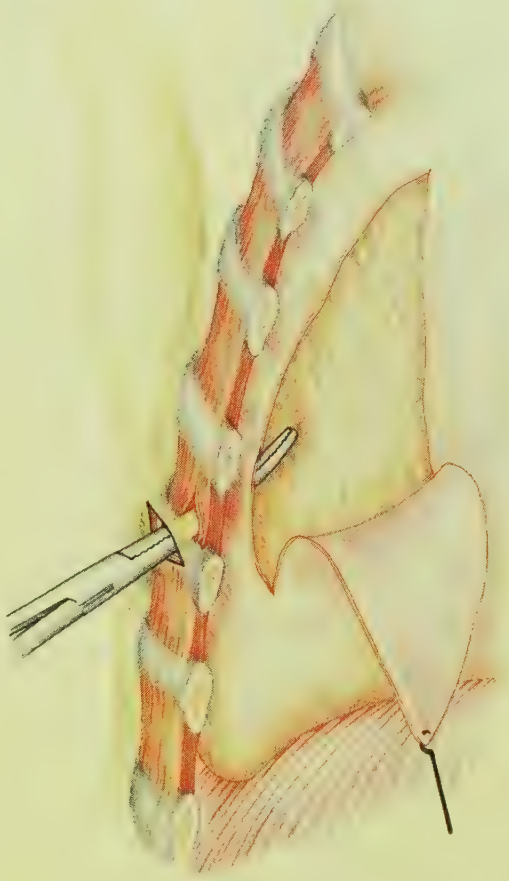
More on medical kits: See p. 165.

Give IV ketamine anesthesia. Cut 3 small side-holes in the tube, and clamp it with an artery forceps 15 cm from the tube end. Wash the chest with soapy water if there is time for it.

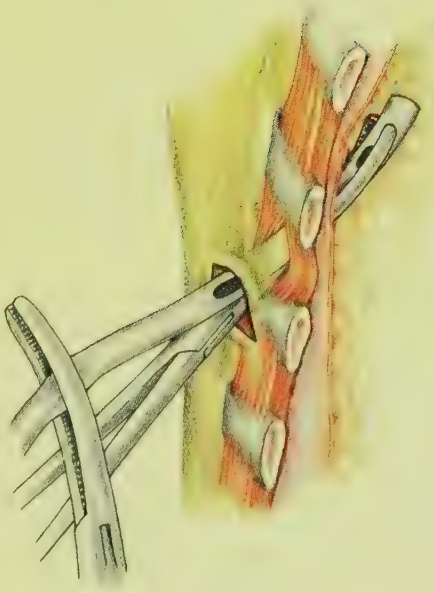
Ketamine anesthesia: See p. 104.

Make a 3-4-cm skin cut parallel to the rib at the level of the nipples (male, arm hanging down).

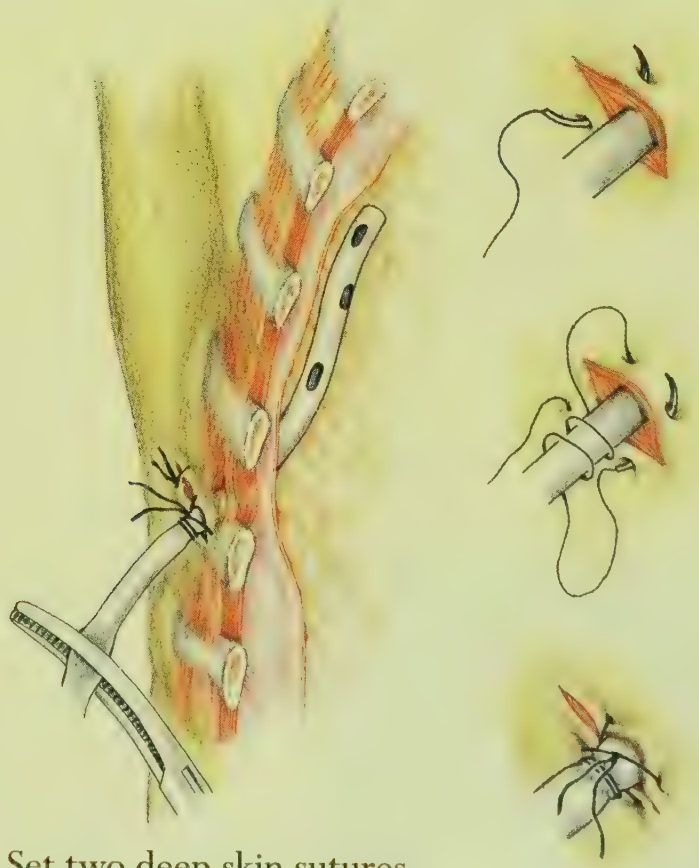
Push the other pair of forceps through the chest wall into the chest cavity. Let the forceps slide over the upper edge of a rib. You hear a snapping sound when you penetrate the pleura. You have to use some force, so support the forceps with one hand against the chest wall, or else you may slip into the lung by mistake.



Open the forceps and withdraw to make a tunnel. Push your finger through the tunnel and feel inside the chest cavity. This is to make sure that the lung is off the inner chest wall.



Push the tube through the tunnel until 15 cm is inside. Note: The tube is still clamped with the first pair of artery forceps.



Set two deep skin sutures (size 2-0) in the skin cut, one suture on each side of the tube. Use the sutures to fix the tube. You can also close the skin and fix the tube with adhesive tape.

How to use the chest tube: See the next page.

How to use chest tube drain

Chest tube drain connected to pistol suction. Afghanistan 1989.

Drainage with water seal.

Chest tube (the tube from the IV drip set) connected to pedal suction. Cambodia 1998.

Without correct positioning, efficient pain relief, and breathing exercises the tube will not drain the chest cavity properly.

Either use suction apparatus

Connect the chest tube to the suction apparatus. Make sure that the connection between the chest tube and the suction tube fits tightly. Remove the artery forceps clamping the chest tube. Use the suction vigorously for about 30 seconds. Again clamp the chest tube tightly with the artery forceps, and disconnect the suction apparatus. Repeat this procedure every 15 minutes all the way to the hospital. If you are carrying the victim, take your time to stop and do the suction.

Or use water seal (plastic bottle)

1. Disinfect a big bottle (boil in clean water for 20 minutes). Fill the bottle halfway with soapy water. Mark the level of water (tape or ink marker pen).
2. Put the chest tube (you may have to elongate it) into the bottle so that the tube end is well below the water level. Fix the tube with adhesive tape to the bottle so that the tube end is always underwater. The bottle outlet must be open so that air can get out.
3. Place the bottle on the ground or floor at a level **lower than** the victim. Or let it hang under the hammock if you are carrying him.
4. Give pain relief and encourage the victim to breathe deeply (see below).

Disinfection in the field: See p. 106.

Blood will run from the chest cavity into the bottle, and air from a pneumothorax will be squeezed out – but only if the bottle is placed at a level lower than the victim's chest. At the same time air cannot enter the chest as long as the tube end is underwater.

Don't let air enter the chest tube

If you don't clamp the chest tube very tightly, or if the tube connections are not tight-fitting, air may be accidentally sucked into the chest cavity through the tube – and the lung will collapse again. If so, start suction once again.

Half-sit and breathe deeply

Better breathing

When the victim is seated, the diaphragm can move freely. This enables the victim to breathe deeply. Deep breaths are necessary to squeeze out blood and trapped air out through the chest tube.

Simple life support for the chest-injured: See p. 48.

Better drainage

The chest tube is placed in the lower part of the chest cavity. When the victim is seated, blood will normally collect around the chest tube and should be drained out through the tube. If the tube does not drain blood, let the victim lie on his side with the injured side down. Turn the victim a little to one side or the other until you find a position that allows the chest tube to best drain the blood.

emoving the chest tube:
o air should be sucked into the
nest when you pull out the tube.
, first place one deep double
ture, but don't tie it yet.

en pull out the tube, and
mediately tie the suture.

Pain relief

Give small doses of IV ketamine every 30 minutes all the way to the hospital. Good pain relief enables the victim to breathe deeply and do breathing exercises.

More on ketamine pain relief: See p. 60.

Comfort and encouragement

Victims with chest injuries are always afraid. Anything that hampers our breathing makes us afraid, like "a fish on dry ground". Fear makes us breathe rapidly, superficially and very inefficiently. So, talk to such victims, encourage and comfort them in order to make them breathe slowly and deeply.

Keep the victim warm

You cannot stop bleeding inside the chest by compression as you do with bleeding limb wounds. But you can help reduce chest bleeding by supporting the mechanism of blood clotting: Cover the victim with blankets, warm him, and give warm IV infusions.

Methods for warming: See p. 56.

Breathing exercises

In addition to telling the victim to breathe deeply, give him one of your rubber gloves and tell him to blow into it as he would "blow up a balloon". In that way, he has to take deep breaths, and blow out forcefully. This is the best way to expand the lung and to squeeze out blood and air through the chest tube. But this exercise is impossible to do without proper ketamine pain relief.

Check victim every 30 minutes

Is the chest bleeding increasing or decreasing? Write in the Injury Chart every 30 minutes how much blood collects in the suction or in the plastic bottle. If the bottle fills with blood, clamp the chest tube, empty the bottle to the mark you made on it, and reconnect the chest tube.

If the tube drains a lot of blood

And if the RR and HR also increase, speed up the IV infusion. But don't force the flow too much – a systolic BP around 90 mm Hg is good. If the BP gets higher than that, bleeding may increase.

Transport of victims: See p. 78.

If no blood is coming out the tube

Don't remove the tube. Leave it in place until the X-ray photo shows that the hemo-pneumothorax is completely drained, and that the injured lung is fully expanded. If the hospital is far away, and you cannot have X-rays done, the tube should be removed after 3 days – but only if no more blood or fluid is coming out the tube.

Chest tube drain – in brief

Better to place one chest tube too many, than not to place any chest tube in a victim who needs it!

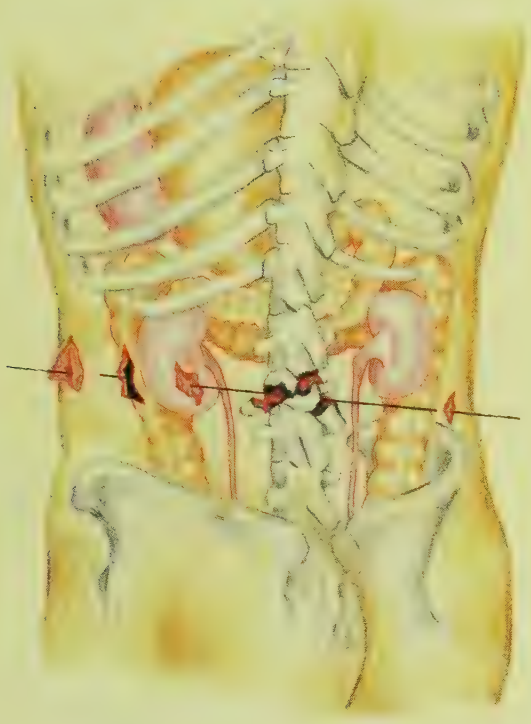
Place the chest tube soon after the injury, before the lung collapses and too much blood is lost.

The victim's position, ketamine, and breathing exercises are vital for the chest tube to work.

Damage control laparotomy – 1

The aim of **damage control** laparotomy is to stop the bleeding from the abdominal organs – **not to repair** the injuries. That repair is difficult, and is done by the hospital surgeon at a second-look laparotomy 24-72 hours after the injury when the patient has good blood circulation, is warm and not in pain.

Laparotomy means opening the abdominal cavity by a surgical cut.

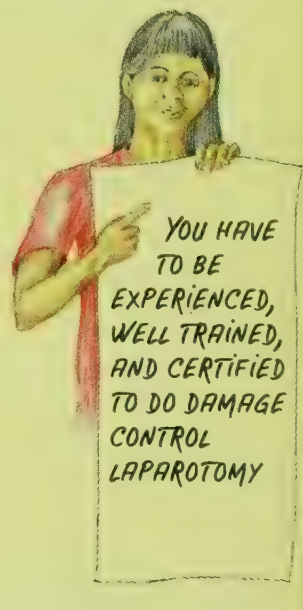


Normally more than one abdominal organ is hit.

Life-saving laparotomy at the Jalalabad front

The battle of Jalalabad had been going on for three years. Alam Khan was one of the few farmers left in Samarkhel village, the majority having fled to Pakistan. In 1991 while farming, Alam stepped upon a POMZ mine. His wife found him one hour later. The mine fragments had torn open his abdomen. She tied her scarf around his waist to keep the intestines in place, and took him on donkey to a military front-line clinic run by the Afghan resistance. When he got there, he was unconscious but still breathing, blood pressure less than 60. After 4 liters of IV Ringer flush infusions Alam Khan was still unconscious with blood pressure around 60. Aziz, a senior nurse in charge of the clinic, decided that damage control laparotomy had to be done. *There are jet fighters up there, we cannot take him to Pakistan until dark. He is bleeding inside and will be dead by then,* Aziz said.

See photo of this injury on p. 23.



They did the laparotomy in ketamine anesthesia with Alam lying on the stretcher inside a tent. Two loops of the intestine were completely torn by the fragment. Aziz tied off the small intestines by gauze bands proximal and distal to the tears. He looked for wounds in the large intestine, there were none. When he extended the wound upward to the breastbone he found the bleeding source: a major tear in the right lobe of the liver. He packed the liver wound and also around the liver with gauze packs, looked for other injuries, found none – and closed the abdomen with skin sutures. Now they got the heart rate down to 120 and the blood pressure up to 90 after IV infusions.

Alam Khan survived the journey across the Khyber Pass to Peshawar city that night. 24 hours after the injury they repaired the abdominal injuries at the Arab surgical hospital. Alam Khan still is living in one of the Afghan refugee camps in Peshawar.

When and where?

Examine the back side too.

First try to stop the bleeding without laparotomy

Don't rush off to the hospital if it is far away. Take time to warm the IV infusions. Take the BP every 5 minutes while flushing in warm IV infusions rapidly through two large-caliber IV lines. Use IV ketamine analgesia, as ketamine helps increase the BP. If the BP is still falling despite 6 liters of Ringer – and the victim is warm – you have no choice but to do a damage control laparotomy.

Also see photo on p. 156.

Don't delay the decision

The more IV infusions you give ahead of the laparotomy, the more diluted the patient's blood becomes. And the more difficult it will be to stop the bleeding during the laparotomy. So, when the decision is

The minimum equipment you need

Scalpel, 6 artery forceps (16-18 cm long), and a small cup to remove blood.

20 gauze packs 10 x 10 cm.

10 gauze packs 20 x 20 cm.

2 towel clamps, thick skin suture, or plastic band to close the midline cut.

Disinfection in the field:
See p. 106.

Ketamine anesthesia:
See p. 104.

made, start preparing for laparotomy at once. Damage control laparotomy can be done in any hut – provided you are trained for it.

Preparations

Examine the front, back, and groin carefully. Find the inlet wounds of mine fragments so that it is easier to locate the bleeding source inside the abdomen.

Warm infusions and two IV lines
The patient loses a lot of heat when the abdomen is opened during the laparotomy. So the IV infusions must be given warm (40-42° C). When you cut open the abdomen, the pressure inside the abdomen suddenly falls. This may rapidly cause more bleeding. Have two large-caliber IV lines running.

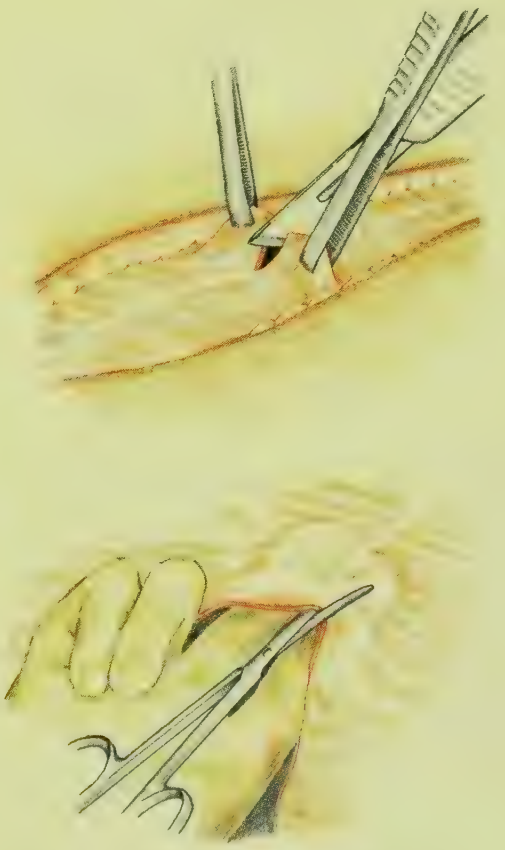
Bladder catheter and stomach tube
If there is no blood in the urine, there is no injury to the kidneys or the urinary tract. Similarly no blood during suction by the stomach tube shows there is no stomach injury. Explore the rectum with one finger up the anus. Blood on the glove means injury to the rectum.

Study the anatomy:
See p. 211 and 212.

You need three assistants
One assistant looks after the airways and gives ketamine and IV infusions. Another retracts the abdominal wall. And one more assists you during the surgery. Give all three exact instructions before you start.

sh the abdomen for 5 minutes
h soapy water from the
ples to the groin. Cut exactly
ng the mid line from the tip
he chest bone, around the
bilicus, and 5 cm further
vn. Don't cut into the blad-
(arrow). Cut down to, but
through, the muscle fascia.
eding from small vessels
er the skin stops by itself.

Wipe the fat off the fascia above the umbilicus. You can easily see where the fibers from the left and right meet. This is the mid line. Cut through the fascia along the mid line. You can now see the peritoneum or the abdominal lining bulge toward you.



The intestines are immediately beneath the peritoneum. You have to lift the peritoneum up before you cut it open, or else you may cut into the intestines. So put one hand into the abdominal cavity, lift the abdominal wall, and cut through the fascia and peritoneum from the upper to the lower end of the skin cut.

Continued on next page

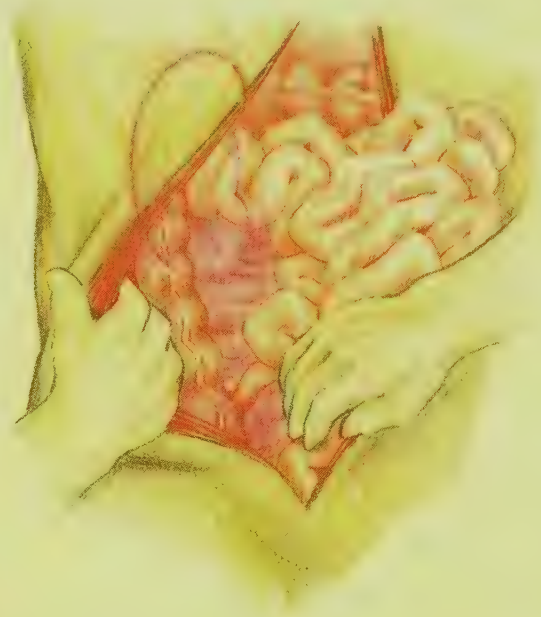
Damage control laparotomy – 2

Take out blood from the abdomen using the cup or your hands as a cup. Suction does not work here. Wipe out the rest of the blood with gauze packs. **Normally more than one abdominal organ is injured.** You have to explore the entire abdominal cavity in a systematic way.

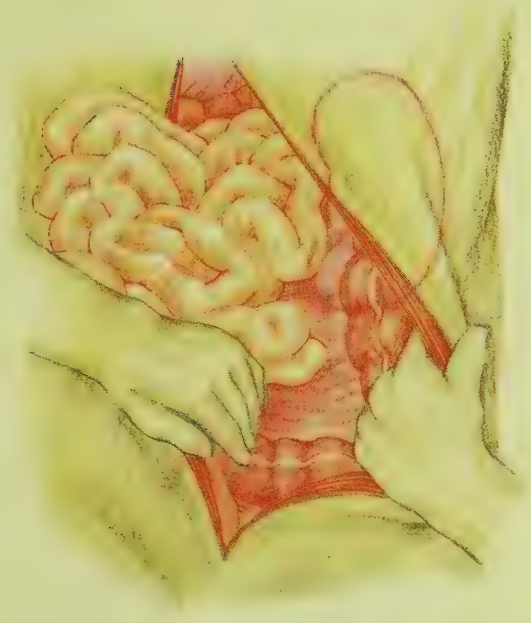
Also see p. 94 and 95.

The right upper quarter: Push the liver upward, the stomach to the left, and the colon downward. Blood in this quarter indicates injury to the liver or the right kidney.

The left upper quarter: Push the liver and the ribs upward, the stomach to the right, and the colon downward. Blood in this quarter indicates injury to the liver, the spleen, or the left kidney.



The right lower quarter: Lift the entire small intestine out of the abdomen to the left. Blood in this quarter indicates injury to the blood vessels at the posterior abdominal wall.

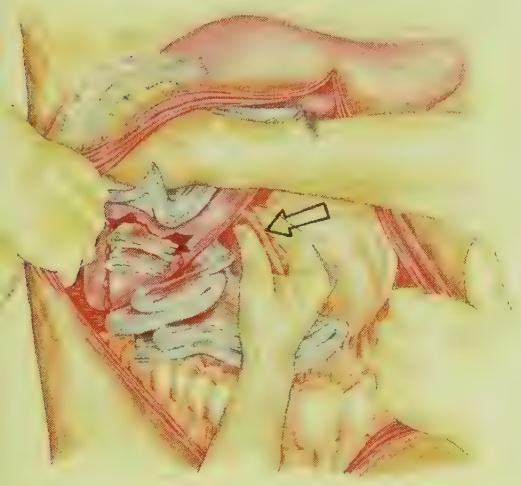


The left lower quarter: Lift the entire small intestine out of the abdomen to the right, and push the sigmoid colon downward. Blood in this quarter indicates injury to the vessels at the posterior abdominal wall.

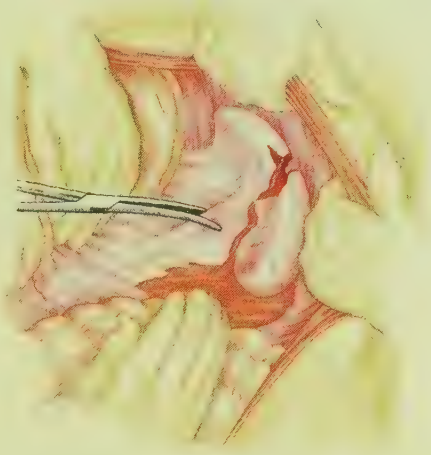
The pouch in front of the rectum: With the small intestine still outside the abdomen, push the sigmoid colon upward, and the urinary bladder (the uterus in females) forward. Blood in this pouch indicates injury to the iliac vessels, or the organs in the pelvic cavity.

If the bleeding is heavy

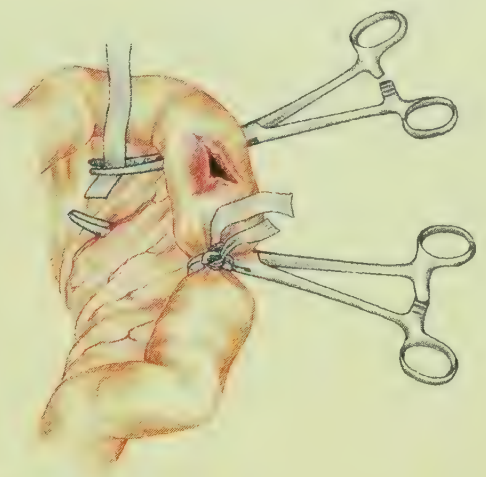
Let the assistant press one hand firmly against the aorta immediately below the diaphragm to the right of the stomach. And with the other hand against the aorta at the level of umbilicus below the kidneys. This helps reduce the bleeding so that you can find the bleeding source.



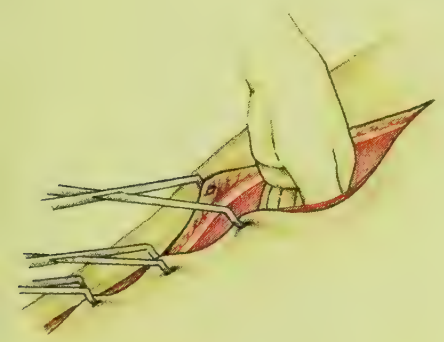
Pack liver or kidney tears with gauze even if the bleeding has stopped. Bleeding may start again if BP rises. First pack into the tear, then pack around the injured organ and fill up the entire quarter with gauze. Press on the packing for 5 minutes to stop bleeding. If it bleeds despite the packing, clamp the artery for 10 minutes with your fingers (arrow).



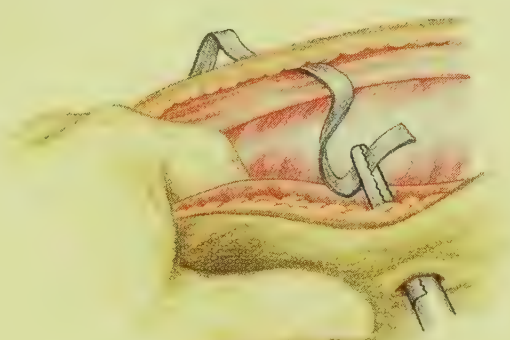
If the spleen is torn, clamp the artery and vein with a pair of large artery forceps. Pack around the spleen and the forceps until the entire quarter is filled with gauze. Leave the forceps inside the abdomen.

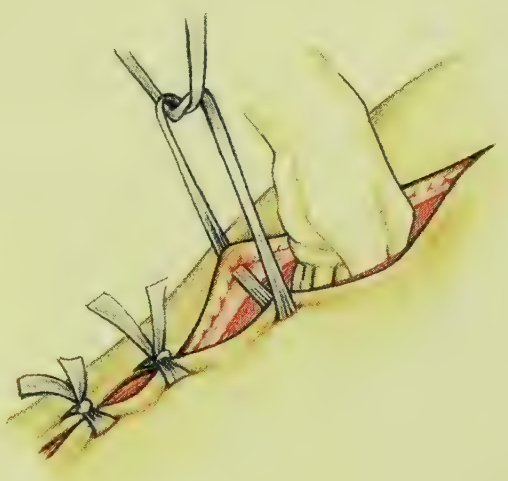


Tie off all holes in the intestine to prevent leaking: Tunnel a hole through the mesentery, pull a gauze band through, and tie firmly. Clamp bleeding vessels in the mesentery with artery forceps, pack gauze around the forceps, and leave the forceps inside the abdomen.



Temporary closure with 12-15 bowel clamps: Close the skin only. Push intestines down so that they don't get trapped.





Temporary closure with plastic ties (from the market): Tunnel holes through the skin, don't include the muscle. Be careful not to trap intestines.

Get to a surgeon within 48 hours

The bleeding is now under control, but the injuries should be repaired at least within 72 hours. Concentrate on good life support during the transport:

- Place a stomach tube before the transport starts. Give IV ampicillin and metronidazole.
- Check RR, HR, BP and skin temperature every 30 minutes throughout the transport. Give **warm** IV infusion and small doses of IV ketamine to keep BP around 90 – just enough for the victim to pass urine. Carry the victim with all limbs lifted: that improves blood flow to the important organs.
- Keep the victim warm.

Training damage control laparotomy: See p. 156-161.

Damage control laparotomy – in brief

This is advanced life support, and not "surgery".

This is only done on victims with severe bleeding inside the abdomen, who would otherwise have died.

Venous cut-down

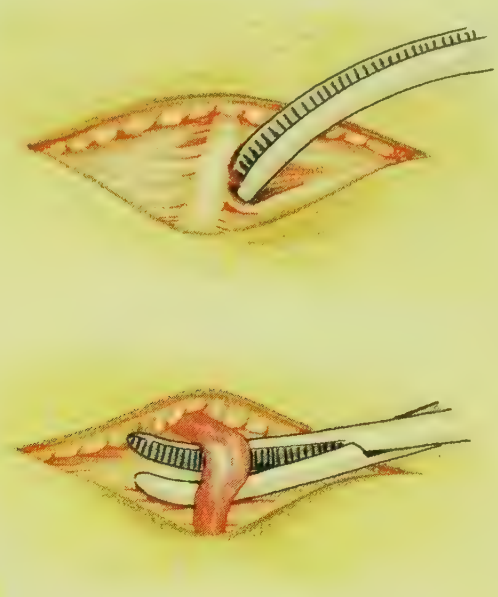
Venous cut-down is to cut through the skin to place a catheter into a vein. Do venous cut-down if you fail after three attempts to do direct IV cannulation.

You need scalpel (knife), tissue forceps (without teeth), surgical scissors, sutures, IV set, and IV infusion. Venous cut-down takes less than 10 minutes if you have trained well. Adults need one single dose of IV ketamine pain relief or local infiltration anesthesia. Ketamine anesthesia should be used for venous cut-down in children.

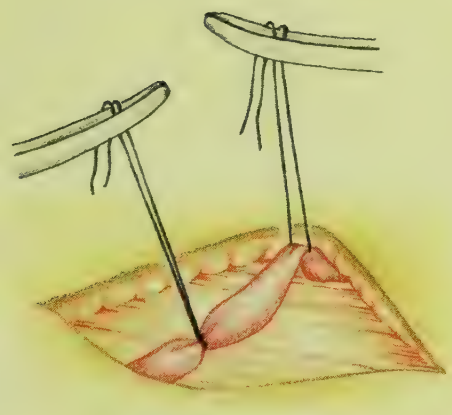
In-field disinfection: See p. 106.

In adults and children older than 10 years: Make a cut-down of the saphenous vein. It is always located two fingers in front of the medial bone at the ankle.

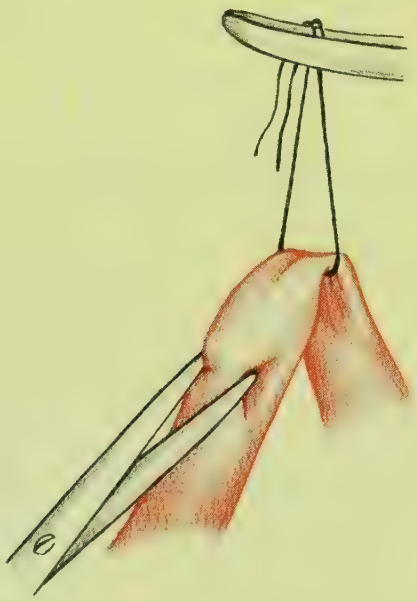
Place a venous stasis (BP cuff at 50 mm Hg) mid-thigh. Wash the skin with soapy water, and make a 3-cm cut through the skin – but not deep: the vein is immediately under the skin.



Find the vein. Use small artery forceps to clear the vein of soft tissues.

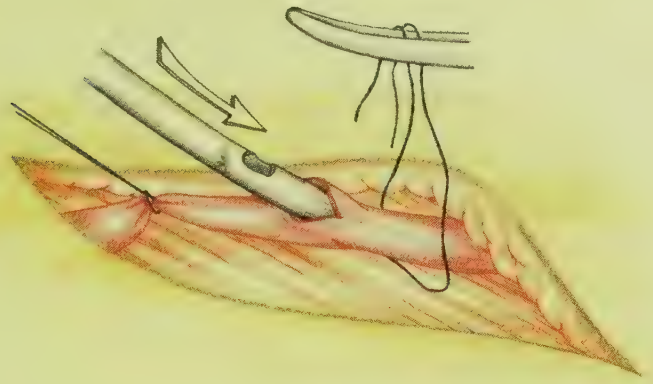


Place two sutures under the vein. Tie the lower suture, but not the upper one.



Make a small cut through the vein's wall (less than half the circumference). Stop the bleeding by lifting the vein by the suture.

Use the sterile IV set tube as IV catheter. Cut the tube end obliquely, and make a few small side-holes. In children less than 10 years: place an IV catheter (at least 1.8 mm) into the vein without cutting the vein open.



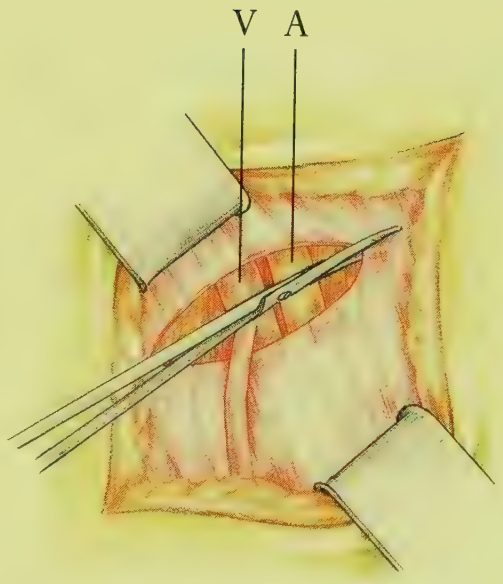
Introduce the IV set tube carefully 20-30 cm into the vein. It should slide upward inside the vein smoothly without resistance. If it does not, the tube is not properly inside the vein. Tie the upper suture tightly around the tube to fix it. There is no time to close the skin cut, just cover it with clean dressing – and give active volume treatment to get BP to at least 90.

Venous cut-down in small children

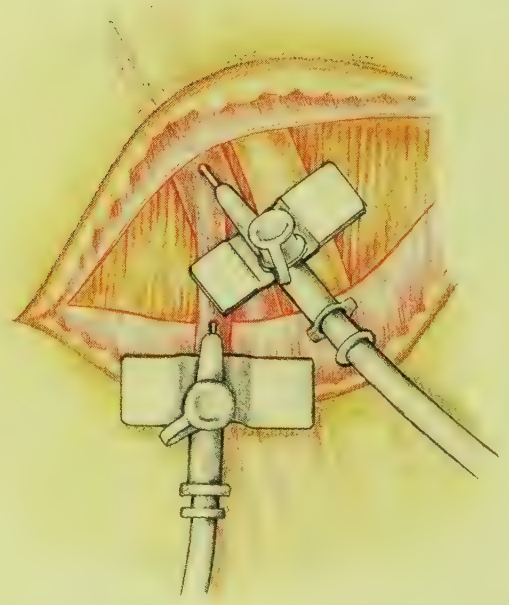
In children older than 10 years a cut-down at the ankle works well. Smaller children have more fat under the skin, and it is difficult to identify the saphenous vein at the ankle when the vein is collapsed. Better do the cut-down of the superficial femoral vein at the groin.

Study the anatomy: See p. 210 and 212.

In children less than 10 years: Make the cut-down at the femoral vein at the groin. The femoral vein is never collapsed. It is always located immediately to the medial (inner) side of the femoral artery. You can exactly locate the femoral artery by finding the pulse beat with your finger.



Make a 4-cm cut through the skin. Note: the vein is not located immediately under the skin, but is deep inside the fat. Find the pulse beat of the artery (A). Use the nose of the scissors or artery forceps to find the vein (V).



Place one or two IV catheters (minimum 1.6 mm) inside the vein. Hold the catheters steady while you squeeze the infusion bag. When enough IV infusion is given to compensate for the blood loss, the limb veins will fill up. Then you can do a standard IV cannulation.

Venous cut-down – in brief

Don't wait too long. If the victim has bled a lot and you have failed 3 times in direct IV cannulation: do a venous cut-down.
In adults: at the ankle.
In small children: at the groin.

Limb fasciotomy – why and when?

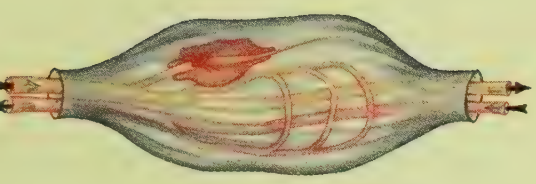
In-field limb fasciotomy. Cambodia 1998.

All muscles are covered by a thin but very strong and non-elastic sheath called the muscle fascia. Fasciotomy means splitting open the fascia that surrounds a muscle. It takes five minutes only. Fasciotomy is done in order to improve the blood supply to injured limbs.

Fasciotomy could have saved Hakkim's leg

Hakkim was an Afghan farmer. In 1990 he stepped on a PMN blast mine while farming. The mine blew off his right foot just below the ankle (see photo p. 24). The amputation wound was not bleeding much, so Hakkim wrapped his turban around the wound and rode his donkey to the village.

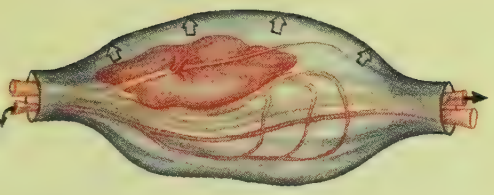
Six hours after the injury he arrived at a makeshift war clinic on the highway to Pakistan. At the war clinic, he had his amputation wound dressed, received 2,000 mL IV Ringer solution, IV pentazocine analgesia, and prophylactic antibiotics. But a below-knee fasciotomy was not done. The car ambulance took Hakkim to an ICRC hospital in Pakistan. Twelve hours after the injury the ICRC surgeons operated on Hakkim. They cut clean the amputation wound and made an ankle amputation stump. Again, fasciotomy was not done. *You can still be a farmer with an ankle amputation,* they told Hakkim.



1. Injury to muscle and artery.

Over the next few days Hakkim felt increasing pain in his right lower leg. One week after surgery, he developed a high fever, and the surgeons had to cut open Hakkim's leg. A lot of pus came out, and the muscles in the front of Hakkim's lower leg were soft and pale – and dead. They had to amputate Hakkim's leg at the thigh. Today he is a big-city beggar in Pakistan.

Injury → swelling → pressure → death



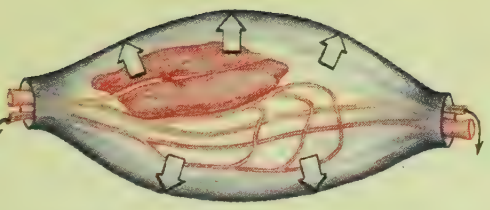
2. The muscle swells and the veins collapse.

When injured, all tissues in our body start swelling – including the muscles. But limb muscles are enclosed in groups inside the non-elastic muscle fascia. Hence, they cannot expand when they start to swell. Instead the pressure inside the muscles increases.

The amputation injury:
See p. 27.

The effects of increased muscle pressure

- First, the veins inside the muscle collapse. Thus less blood is drained from the muscle: The pressure in the muscle increases.
- Then, the small arteries collapse due to the pressure. This means local oxygen starvation: It adds to the injury and further increases swelling and pressure.
- Eventually, the bigger arteries collapse. The trapped muscle is shut off from the blood supply: The muscle starts to die.



3. Pressure increases, also the arteries collapse. The muscle is trapped inside the fascia.

Trapped muscles become infected

The muscles around the amputation wound are impregnated with dirt and bacteria. There is a high risk of infection. Infection begins soon and will be more serious if the muscles also become trapped and short of oxygen. This is why early fasciotomy also helps prevent infection of the amputation stump.

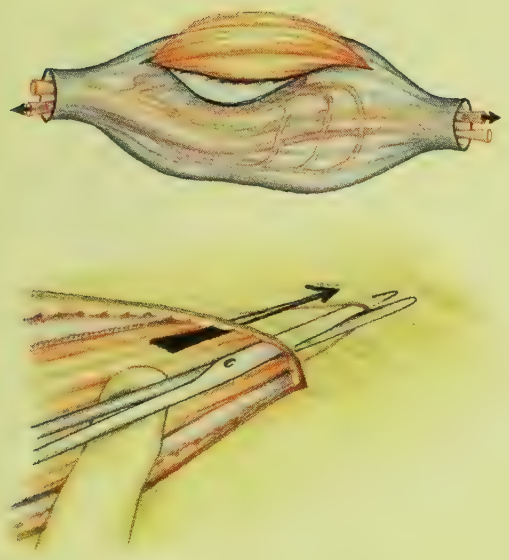
Signs of muscle being trapped

- Early sign: The pain in the amputated limb is increasing hour by hour, instead of decreasing.
- Late sign: The limb above the amputation wound becomes cool. The limb is already dying.
- Very late sign: The limb feels numb and the victim cannot move it. By this time the nerves and the muscle tissue are already half dead.

Who needs fasciotomy?

- **Victims with signs of muscle entrapment:** Do fasciotomy immediately – be it outside or inside the hospital.
- **Victims with tourniquet:** Remove the tourniquet and do fasciotomy immediately. A tight tourniquet causes trapping of muscle, in particular if the BP is low. When the BP is low even a slight increase in the muscle pressure causes collapse of the blood vessels.
- **"Dry" amputation wounds:** If the wound does not bleed, the reason is probably trapping of muscles with collapse of arteries in the stump. Do fasciotomy without delay if the victim cannot reach the hospital within 4 hours after the injury.

More on tourniquets: See p. 32.



4. Setting free the trapped muscle: Split the fascia with scissors. When the muscle bulges through the fasciotomy, the pressure inside the muscle immediately falls – and the blood-flow inside the muscle increases.

First compressive dressing – then fasciotomy

1. **Treatment by village first helpers in the field:** Pack the amputation wound with gauze or cloth, and apply compressive dressing on all amputations – regardless if the amputation wound bleeds a lot or not. One reason for "dry" amputation wounds may simply be that the victim has lost so much blood already that there is no blood-flow through the limb. Unless packing and compression is done in the field, that victim may start bleeding heavily during the transport after a few liters of IV infusion. This is why we recommend careful packing-compression as a forward routine for all amputation cases.
2. **Assessment by trained medics in the village:** When the victim comes to the medic, the compressive dressing and packing should be removed to assess the injury. If the wound does not bleed despite BP at 90 or more, fasciotomy should be done there and then – unless the hospital is close by. (Minor bleeding during the fasciotomy is controlled by pressure on the main proximal artery.) If the wound bleeds well when the packing is removed, there is probably no reason to do fasciotomy – unless the victim had the tourniquet for more than one hour.

Limb fasciotomy – how?

What you need for fasciotomy

Ketamine anesthesia.
Clean instruments: scalpel, surgical scissors, tissue forceps, and artery forceps.
Gauze packs and elastic bandages.

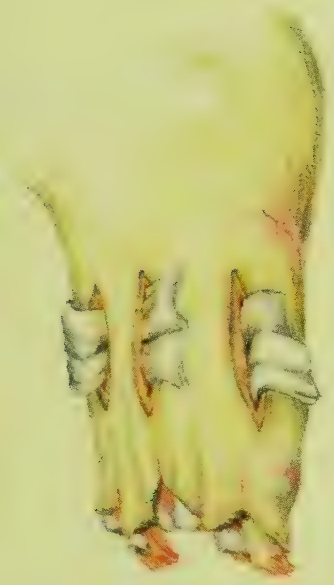
There are two types of fasciotomy:

- Segment fasciotomy – a fasciotomy one segment above the amputation wound.
- Stump fasciotomy – when you split the fascia from the amputation wound upwards.

Study the anatomy carefully: See p. 209 and 210.

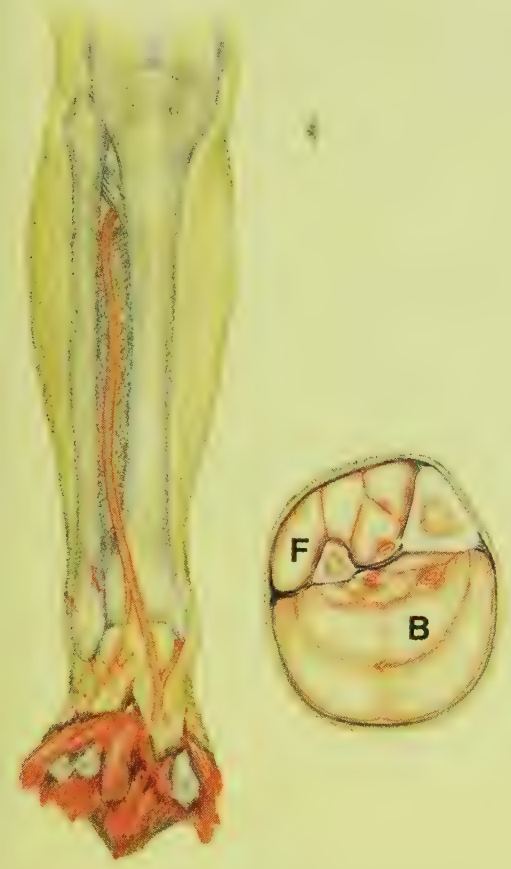
Segment fasciotomy: Make a 10-cm skin cut. Wipe the fat off the fascia. Make a small cut in the fascia and split the fascia lengthwise upward and downward with scissors. Open the scissor blades just a little and push it under the skin without moving the handles. The total length of the fasciotomy should be 2/3 the length of that limb segment (e.g. the thigh).

Stump fasciotomy is done on long amputation stumps. Find the rim of the fascia, and split the fascia upward by pushing a scissor blade under the skin.

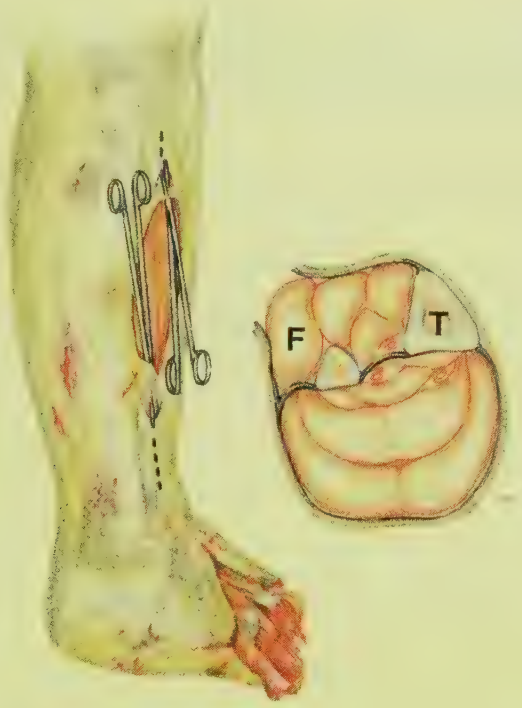


Fasciotomy at the foot is needed if the mine tore off the forefoot. Three fascia rooms under the foot should be opened. Make three separate skin cuts. Open the fascia on the upper side, and use artery forceps to push a gauze band into each of the three rooms.

Fasciotomy at the hand is needed if the mine blew off several fingers or parts of the hand. Make a skin cut from the skin fold in the hand to above the wrist. Split the fascia exactly along the mid line from the skin fold to above the wrist. When the fascia is split, you can see the finger tendons underneath.



There are two fascia rooms in the lower leg: one is in front of the two bones (F), and one is at the back (B). The arteries and veins lie deep inside the fascia rooms. The room at the back is larger, it can take more injury without trapping the muscles.



Fasciotomy at the lower leg is needed if the mine tore through the mid-foot or the ankle. You only need to open the fascia room in front (F). Make a 10-cm skin cut parallel to the crest of the tibial bone (T), 5 cm to the side of the crest of the tibia. Split the fascia upward and downward under the skin.

Stump fasciotomy is done on long below-knee stumps. Both fascia rooms should be opened – the one in front and the one at the back. The fasciotomy at the back section is best done along the mid line.

There are also two fascia rooms for the forearm. One in front of the two bones (F), and one at the back (B). The muscles in front have better blood supply, and can take more injury without becoming trapped. The artery at the back (arrow) is especially at risk. So it is more important to do fasciotomy at the back of the forearm.

Segment fasciotomy below the elbow is needed if the mine tore through the hand or the wrist. Make a 10-cm skin cut at the back fascia section, and split the fascia upward and downward.

Stump fasciotomy is done on long below-the-elbow stumps. Do fasciotomy both in front and at the back.

Training for fasciotomy: See p. 154.

Fasciotomy – in brief

Fasciotomy helps to save limb length and prevent infection.
Fasciotomy works if it is done early, within 4 hours after the injury.
Fasciotomy should be done on all victims brought in with tourniquets.

Ketamine anesthesia

Anesthesia means "no sensation of pain".

Note the difference between anesthesia and pain relief:

For ketamine anesthesia we give IV ketamine 2 mg/kg body weight. Within 3 minutes the victim will sleep deeply and feel **no pain** at all.

For ketamine pain relief we give IV ketamine 0.2 or 0.3 mg/kg body weight. Within a few minutes the victim feels less pain, but he will still be awake and feel some pain. See more on p. 60.

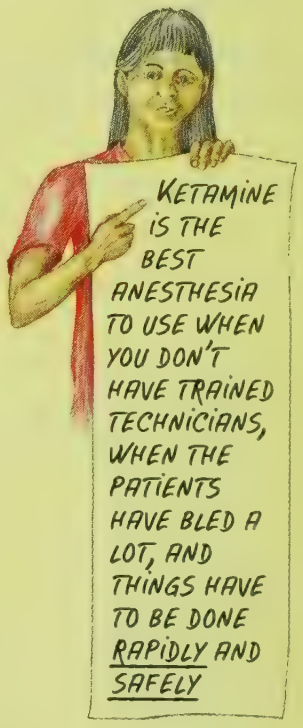
When do you need anesthesia?

Ready for fasciotomy in ketamine anesthesia. Afghanistan 1990.

Use ketamine anesthesia for victims with injuries that need life- or limb-saving surgery:

- chest tube
- venous cut-down
- fasciotomy
- damage control laparotomy
- wound debridement.

In rare situations you may need to use ketamine to rescue victims trapped under fallen trees, destroyed houses, in car wreckage etc.



Ketamine anesthesia is safe

- Under ketamine anesthesia the victim breathes by himself (unless you give the IV dose too rapidly).
- Ketamine increases the heart rate and blood pressure, while most other types of anesthesia have the opposite effect. Thus, ketamine anesthesia is safe for victims who have bled a lot.
- Under ketamine anesthesia the gag reflex is working, and the victim is able to protect his airway if he vomits. Still you should be ready to immediately place the victim in the recovery position in case of vomiting.

Side-effects

Unrest

Ketamine can cause unpleasant dreams and unrest, but less if there is silence (no noise! cover victim's ears) and if it's dark (close victim's eyes). Small doses of IV diazepam help reduce these side-effects.

Don't use diazepam in children.

Salivation

Ketamine increases salivation. This may cause airway problems, especially in children. Atropine prevents salivation: give a single dose before you give the ketamine starting dose.

Difficult to assess blood circulation

Atropine increases the heart rate (but not the blood pressure), ketamine also increases the heart rate. As the heart rate is affected by both

drugs, it is no longer a good early indicator of blood loss. Be on the safe side: give a lot of IV Ringer during the anesthesia.

Giving ketamine anesthesia

- Fill in the Anesthesia Chart.
- Have suction ready, and one helper who can immediately place the victim in the recovery position in case of vomiting.
- If victim has bled a lot: Place two IV cannulas and give 2,000 mL Ringer rapidly before starting anesthesia. If the situation is desperate, and the victim needs e.g. a chest tube or damage control laparotomy urgently: go ahead with the anesthesia when the IV line is in place.
- Keep the victim warm during the anesthesia.

Anesthesia Chart: See p. 230.

First atropine and diazepam

For all: IV atropine, one dose according to the dose chart. Only for adults with BP at 100 or more: IV diazepam 2.5 mg.

Drugs and doses: See p. 178-181 or pocket folder at back cover.

Start the anesthesia

Give ketamine 2 mg/kg body weight slowly IV (let the injection take one minute). Anesthesia is usually effective after 2-3 minutes, check with needle prick on the skin. One IV dose of ketamine works for 10-15 minutes. If you need anesthesia for more than 15 minutes, give 1 mg/kg IV every 10-15 minutes, or when the victim shows signs of pain.

Waking up

The victim will wake up slowly within a few hours, and gradually start feeling pain. Give IV pain relief in this period (pentazocine rather than ketamine to make victim wake up sooner). Observe airways, breathing, and circulation closely during this period.

No IV line? Give IM ketamine anesthesia

- First, IM atropine (same dose as for IV). No diazepam!
- Then, IM ketamine 10 mg/kg (two separate injections to reduce injection pain). Within 5 minutes the victim will be under anesthesia. One single dose works for 20-30 minutes.
- Try IV cannulation again. If you fail, do venous cut-down. Continue with IV ketamine anesthesia.
- If you still cannot find a vein: Maintain anesthesia with IM ketamine 5 mg/kg at 20-minute intervals.

Ketamine anesthesia – in brief

Pain is harmful! Use ketamine anesthesia, also in the field, for all painful measures.

Ketamine anesthesia is safe and efficient
– if you use repeated slow IV injections at correct doses
– if you have one helper who takes care of the airway
– if you watch the victim closely until he is awake.

Disinfection

Disinfection means killing bacteria, viruses, and parasites. It can be done by heat or by chemicals (disinfectants). Soap is one disinfectant. Some procedures must be done with disinfected hands and disinfected instruments. In other cases, the wound is already so dirty that disinfection is a waste.

Sterile = all bacteria are killed. Disinfected = most bacteria are killed.

"Dirty" procedures

To stop bleeding

Bullet wounds and mine wounds are dirty already. You do not need to wash hands or disinfect gauze to stop bleeding from these wounds. The most important thing to prevent infection is to stop the bleeding and take the BP up to 90 mm as soon as possible.

Bacteria and infection: See p. 64.

For the airways

There are always bacteria in the airways and esophagus. Tubes and equipment should be clean, but you do not need to disinfect them.

"Clean" procedures

Injections, IV cannulation, and venous cut-down

You must not introduce bacteria into the bloodstream. Needles and IV cannulas must be sterile. Surgical instruments and suture materials must be disinfected.

Cutting through the skin

For fasciotomies, chest tube placement and damage control laparotomy you need to disinfect your hands, gauze, and instruments.

Wash in cold water before you disinfect: For the disinfectant to act – be it heat or a chemical agent – the instruments must be clean. Blood and body fluids clot at 43° C and in contact with chemicals. Both your hands and instruments should be brushed in cold water without soap before you start disinfecting them.

Four ways to disinfect

Boiling for 20 minutes will kill most bacteria.

1. **Soap** is not a very strong disinfectant. It has to be used for a long time before it kills most bacteria. Use the cheap traditional soap found in most markets. The water should be clean, and if possible, boiled for 20 minutes.
2. **Isopropanol** is a very strong disinfectant. Isopropanol is a widely used chemical. You can get it at petrol stations and paint shops. It is cheap. Place the instruments in a box with 45% isopropanol. Disinfection takes 1 minute. Then pour off the isopropanol fluid and let the instruments dry in the air for a few minutes before you use them.
3. **Chloramine** is a strong disinfectant. You can get it at the pharmacy. Place the instruments in 5% chloramine solution for 1 hour. Use gloves for protection. Rinse the instruments with boiled water afterwards.

4. **Heat** is a good disinfectant. Boiling in water for 20 minutes will kill most bacteria. To kill tuberculosis bacteria, instruments have to be boiled twice: Boil for 20 minutes, cool the instruments, and boil for another 20 minutes. **Note:** Some plastic and rubber instruments become damaged when boiled.

Pressure boiling is even more effective.

Disinfection of the skin

If you have sterile gloves, use them. But first wash your hands for 2 minutes in soap and clean water. If you don't have sterile gloves:

- You can disinfect rubber or latex gloves yourself (see below).
- Or you can work without gloves: Wash your hands for at least 5 minutes in soap and clean water.

Always use gloves in HIV areas. See p. 77.

Disinfection of rubber and plastic

Wash in cold, clean water. Then place in soapy solution for 2 hours, in isopropanol 45% for 1 minute, or in chloramine 5% for 1 hour. Let the disinfected items dry well before you store them, or else they become rotten. It is best to let them dry in the sun.

Disinfection of surgical instruments

Use alcohol to remove protective oil if there is any. Brush in cold, clean water. Open the instruments and boil them in water for 20 minutes. Before storing, dry well in the sun to prevent corrosion. You can also use isopropanol or chloramine for disinfection.

Disinfection of gauze and clothes

First rinse in cold water without soap, then wash with soap. Then boil in water for 20 minutes. Let them dry completely in the sun before storing.

Work cleanly in the field

Disinfect instruments and gloves every 2 weeks. Store them in an airtight box that has also been disinfected. Disinfected gauze should be packed and stored in a disinfected plastic bag. Also disinfect a few towels or sheets of tight woven cotton (1 x 1m), dry them in the sun, and wrap them in airtight plastic. Before you start work on the victim, place these towels on the ground to prevent the instruments and sutures from becoming dirty.

What about emergencies?

You may say: *I have no time to boil things for 20 minutes in an emergency!* This is true. If a patient has a blocked upper airway and you are not able to pass in the endotracheal tube, you have to do an airway cut-down with any sharp knife at hand, no matter how dirty that knife is. If you do not do this, he will die even before the water starts to boil. Do not worry about disinfection in emergencies.

Disinfection – in brief

You should know when disinfection is necessary – and when it is not.

Always have disinfected equipment ready. Either disinfect your equipment every 2 weeks and store in an airtight box. Or have a bottle of isopropanol at hand.

Points to note – Section 4

If I read it, I forget it.
If I see it, I remember it.
If I do it, I know it.

(Old Chinese saying)

People differ, and so do accidents, transport and distances. No one injury is like another. That is why we cannot simply apply fixed rules in working with the wounded. In our training courses, the best lessons have been given by the students themselves when they report difficult injury cases to one another, and discuss which kind of treatment was the best. Some of those cases are reported in Section 4. Use your own experiences and case reports when you study and discuss life support. Successes – or failures – in solving real-life problems are more important than book-based learning.

Section 4:

Case stories from real life

He drowned in the river

It was April in Kurdistan, North Iraq. The sun was warm, the snow was melting, with the hills and mountains fast turning green. Hero, 10 years, remembered April last year: they had just started plowing the fields when the Turkish army invaded the province – and they had to flee deep into the mountains. Now it was all happening again: F16 planes in the skies, burning villages, Turkish tanks on the roads. For the second time they had to flee from their land.

They had been walking for hours in a mountain valley, and came to the point where they should cross the river. Swollen with melting snow from the mountains, the river current was strong. Hero was holding the hand of her 5-year-old brother Raof. Suddenly Raof's foot slipped and he fell. Hero tried to hold onto him, but he disappeared in the river. Hero saw Raof's head further downstream, and screamed for help. Hero's father ran down the river, dived into the ice-cold water, and finally got hold of Raof. When they got him ashore, Raof, pale and bluish, lay still as though dead.

Be strong! Take command!

Hero screamed to her mother: *Get somebody to find Rahim, the medic!* She knelt beside her lifeless brother, holding his hand, desperately waiting for the medic. She had to do something. She tried to remember what Rahim had told her and the other schoolchildren at the training course last winter: that they should try to give rescue breathing to mine victims even if they did not seem to be alive. Raof was not a mine victim – but could she still use what she had learned from Rahim?

Hero looked at her brother, was he breathing? She placed her ear to Raof's mouth and listened: there were no sounds. Her brother was not breathing. Hero blew air into her brother's mouth twice, then looked at him. No, he was still not breathing by himself. She felt for pulse beats at his neck, but felt nothing. Hero realized that Raof was dying in her hands. *Rahim, come quickly! He is dying!* she shouted. Her father was lying on the ground in his wet clothes. Her grandmother was there too, weeping loudly.

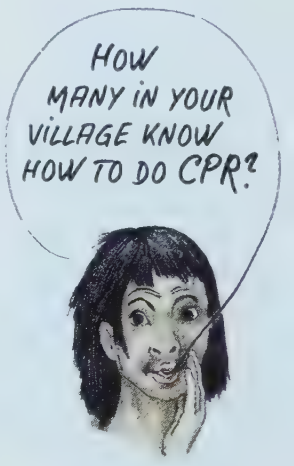
Be strong! Take command! Rahim had told them at the training course. *Stop weeping, come and help me,* Hero told her grandmother. *Press hard five times here between the nipples when I tell you. Now, press!* Hero tilted Raof's head backward and gave mouth-to-mouth rescue breathing, once for every five chest compressions. *That's good, grandmother! Count loudly each time you press.*

CPR: See p. 68.

Advanced CPR

When Rahim came running to the site, he saw from a distance that they were giving CPR to a small child. *They are strong, our Kurdish girls,* he said to himself. Hero paused to tell Rahim what had happened. *You've done very well, Hero,* Rahim said. He examined Raof: There was still no reaction, no breathing and no pulse. *Give him a few more rescue breaths, Hero. Then I'll intubate him.* Rahim introduced the laryngoscope in Raof's mouth, but could hardly see anything due to the bright sunlight. *Shade me from the sun, Hero. Yes, that's better.* He passed in the endotracheal tube successfully, and connected the self-inflating bag.

Now Hero, fix the tube with one hand and press the bag with the other to blow air into your brother – just as you did with the mouth-to-mouth breathing. One breath for every five chest compressions. Go on pressing the chest, grandmother! Rahim took out IV cannulas and a plastic box with drugs from his backpack. He put the IV cannula in the external jugular vein at Raof's neck, and fixed it with tape. *Now, what is the dose of adrenaline for this small boy?* Rahim asked himself. He looked at his pocket folder with drug doses for children. *Five years old, that should be 0.2 mg adrenaline IV. Mix one mL of adrenaline with 4 mL Ringer, then you have 0.2 mg adrenaline per mL,* Rahim read. Rahim did so, and then injected 1 mL of the mixed adrenaline-Ringer solution in Raof's IV cannula. *Now, grandmother, let me press the chest. Hero, just go on with the breathing bag!*



After two more minutes with CPR, Hero shouted: *Look, Raof is breathing!* Rahim saw the boy's chest move. He also felt weak pulse beats at his neck. *Your brother will survive, Hero,* he said. *But continue to press the bag gently to help him breathe better.*

Alive – but dead cold

Rahim looked around and saw Raof's father still lying on the ground. *Please, look at him, grandmother. Talk to him and see if he answers.* The old woman knelt beside her son and asked: *Are you all right?* Raof's father grunted weakly. He was shaking from cold, lying in his wet clothes. Rahim placed his hand on Raof's stomach – the boy's skin was ice-cold too. *They are both ice-cold, get blankets and some hot tea!* Rahim shouted. They removed the wet clothes from both father and son, and wrapped them in dry blankets. Raof was half-awake now, he was coughing and tried to pull out the endotracheal tube. Rahim removed the tube, but remained seated beside the small boy, counting his breathing rate every five minutes.

Keeping victims warm:
See p. 56.

Raof and Raof's father survived

Raof was sitting wrapped up in blankets in his mother's lap, still drowsy, sobbing weakly. His father was OK after some cups of hot tea. Hero was sitting at a distance from the others, looking into the river, crying quietly. Medic Rahim went to sit at her side and put his arms around the skinny girl. *It was all my fault,* Hero sobbed. Rahim shook her gently and said: *Hey, look at me and listen carefully, little sister. Those responsible for this accident are the bloody Turkish generals. We were completely exhausted all of us. So nobody can blame you for letting Raof slip out of your hands into the river. That could have happened to the strongest of our men. You gave your brother's life back to him, Hero. You are the real, little hero.*

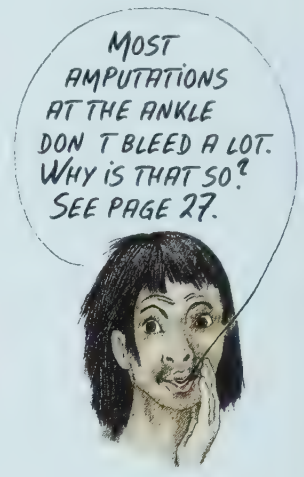
Comfort and encouragement:
See p. 62.

Grandma lost her foot

This is a story from Angola. Viola (58 years) was walking with her two grandchildren to attend a wedding party in a village quite far off. Viola was very thin, and at intervals she would cough heavily. She had pulmonary tuberculosis but could not afford the necessary medical treatment. They paused by a river at sunset.

While collecting wood for a fire, Viola lost her foot to a blast mine. When the two girls saw the ragged stump and Viola's agony, they burst into tears. The young one started crying for help. *There is no use shouting,* Viola said. *Nobody can hear you here. Tie something around that leg to stop the bleeding, and take me home. – No, we cannot do that,* Isabelle said. She was 13 years old. *In our village there are no doctors and no medicines, and it is two days from here. The hospital is only three days off, two, if we are lucky. You know, the teacher taught us schoolchildren first aid last year. Let me take you to the hospital, grandma. Please!* Viola was too weak to protest.

Isabelle (13 years) gives first aid



Isabelle placed the old woman half-sitting against a stone and told her sister to lift the injured leg. The amputation wound was ugly, but blood was only dripping slowly. Isabelle cut out pieces of Viola's cotton dress, packed them inside the wound – and the bleeding stopped. *You are killing me,* Viola moaned. – *No, I'm saving your life,* Isabelle replied. Then she cut long pieces of cloth, 10 cm wide, and wrapped them tightly around the injured leg from the amputation wound to the knee.

Sister, run to the next village, Isabelle said. *Tell them we need a bicycle to carry grandma. And more food. But don't leave the path, there are mines around.* Isabelle placed another stone to elevate the injured leg and prepared soup of maize and dried salt fish. That was all they had. *I'm in pain and I'm not hungry,* Viola said. – *But Grandma, you have lost blood and we have no IV infusions for you. You have to drink at least two liters each day.* Isabelle felt confident now. And Viola followed her orders.

Volume treatment by drinking: See p. 53 and p. 183.

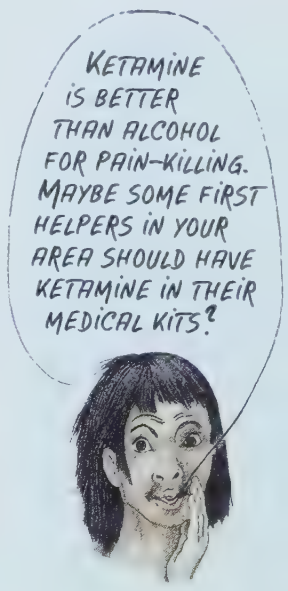
Bicycle and alcohol

That night was long and painful. The next morning Isabelle's sister came with the bicycle. Together with her came two young men with sweet potatoes, bananas, and a bottle of ghee. *We couldn't let her go at night. Most roads around here are mined,* the men said. *We are not in a hurry,* Isabelle replied. *Right now food is more important than getting to the hospital quickly.*

She prepared a good meal of fried bananas and potato porridge and made Viola eat the food. She also mixed some porridge with water for Viola to drink. The two men carried Viola to the bicycle and started the long march to the hospital.

They spent the next night in a roadside village, Viola sitting with double blankets around her (even in Africa nights are cold). The villagers flocked around them, and Isabelle asked for IV infusions and drugs. They had no infusions, only some expired tablets of chloramphenicol 250 mg. Viola was given 4 tablets. There were no

painkillers available, only a local brand of alcohol. It was 24 hours since the injury and Isabelle could see Viola was exhausted from pain. She gave her two spoonfuls of the "whiskey" and could note after 30 minutes that Viola's heart rate came down towards normal. From there to the hospital Viola had one spoonful of whiskey every 2-3 hours for pain relief.



Cleaning the wound with soap

The second morning, 36 hours after the injury, Viola had fever. The heart rate was rising although there was no bleeding through the dressing. But the dressing soaked in old blood smelled bad. Isabelle reckoned a wound infection was setting in, and asked for boiled water and soap. *There is no soap except for the one we make ourselves,* the women replied. *That one is as good as any,* Isabelle replied. She gave her grandma another spoonful of whiskey. After 30 minutes she removed the dressing and placed the amputation stump in a bucket of warm soapy water and washed it. Then she packed pieces of clean cotton cloth into the wound and again wrapped the foot and leg in a tight circular dressing of broad bands of cotton. When Viola had eaten, she was carried to the bicycle again. Behind her came the two sisters carrying two liters of soup.

More on soap and other disinfectants: See p. 106.

Viola was obviously weaker now, and they had to pause every hour. But Isabelle insisted that Viola continue to drink soup. When they reached Leua town Isabelle undressed the wound, put the limb in soapy water for 30 minutes, and dressed it again. The wound was obviously stinking by now. They went by truck to Luena the next morning and arrived at the Provincial Hospital in the afternoon.

Limb-saving surgery

The hospital nurses examined Viola: Breathing rate 30/min, heart rate 110/minute, blood pressure 110 mm. Viola was anemic (hemoglobin 8 g%) but that was probably not from blood loss, but due to chronic anemia caused by the tuberculosis.

Diseases that complicate injuries: See p. 76.

At the Provincial Hospital they operated on Viola that same night. They did fasciotomies at the lower leg and could see that the blood supply to the amputation wound was reasonably good. They therefore decided to amputate Viola through the ankle joint (Syme's amputation). If that amputation could heal without infection, Viola would have an amputation stump on which she could walk without using prosthesis. After the operation the surgeon went to see Isabelle and her sister.

More on limb-saving surgery: See p. 26 and p. 100.

A surgeon assesses Isabelle's treatment

The surgeon had to wake up the two sisters. *Your grandma is in good shape,* he said. *I can probably save her leg. But tell me, it has been three days since the injury. What did you do to her along the way?* Isabelle told him about bleeding control without a tourniquet, oral volume treatment with soup, local "whiskey" as painkiller and soap-baths for the amputation wound. The surgeon smiled. *I couldn't have done better,* he said. *Now go and get some sleep.*

Stopping limb bleeding

Some families in Mae Rian village in Cambodia could afford to buy kerosene at the market. But not farmer Rattana. Every three weeks he would go with his donkey and two neighbors to the woods west of Bavel River to collect firewood for cooking even though everybody knew there were mines in that forest. Talking stopped when the three farmers approached the forest, they were afraid. They tied up their donkeys and entered the forest, axes on their shoulders. It was the rainy season, the forest was dripping wet. Rattana was about to climb a tree to break off some dry branches, neighbor Han was just behind him. Suddenly Han shouted, then there was a big bang – then all was silent. Han lay a few meters away in a crazy position, half his face was blown off. Rattana could get up, but his right leg could not support him. *Bun Sat! Help us!* Rattana shouted.

First aid by farmer

Bun Sat came running, looked at his dead neighbor, at the tripwire at Han's foot, and at the splintered tree. *Fragmentation grenade with tripwire,* he said. *You were ten meters from the grenade when it exploded.* Bun Sat cut away Rattana's trousers with his knife. The right thigh was swollen and bent in a strange way. A wound at the thigh was not bleeding much. Bun Sat tried to lift the leg in the correct position, but Rattana cried out in pain. *It's broken my friend,* Bun Sat said. *I have to splint it before I take you to the donkey. Or else the pain will kill you.*

Fragmentation mines: See p. 20.

Bun Sat now packed his jacket between Rattana's thighs and tied the right leg firmly to the left with their neck scarfs. When he had finished, he saw Rattana had fainted, but he was still breathing. Bun Sat noticed that the injured man's pulse beats were getting fainter and far more rapid than his own. The thigh wound had stopped bleeding. *Let's go, it will be late at night before we get to the village,* Bun Sat said to himself.

Bun Sat laid Rattana across a donkey. Rattana was dripping wet and cold. Although Bun Sat felt cold himself, he took off his own shirt and wrapped it around Rattana. He recalled Heng had said: *Cold people bleed more.* They could not move fast. Every now and then Bun Sat had to stop and see if Rattana was still alive. Though he was not awake, Bun Sat could hear him moan. It was dark and still raining heavily when Bun Sat finally entered Mae Rian.

Warming: See p. 56.

Finding the main problem

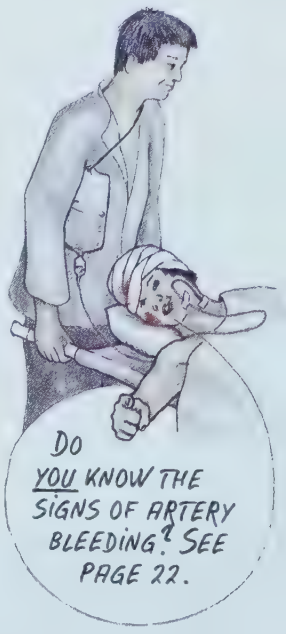
Heng was doing some paperwork in his small bamboo clinic when Bun Sat arrived with the three donkeys and Rattana. Bun Sat told him: *It was a frag grenade – the explosion around noon. Han was killed immediately. Rattana was 10 meters from the explosion. He has a broken leg. He fainted when I splinted the leg. Since then he has not woken up. I think he is breathing well, but his heart beats very fast – and he is very cold.*

Heng examined Rattana: He was not awake, but he cried in pain when Bun Sat released the splinting on his leg. Rattana was pale, the skin was cold all over, and he was shivering. Breathing rate 30 per minute. Heart rate 130 per minute. Systolic blood pressure 90 mm Hg. Temperature 33° C. *He has lost a lot of blood and is very cold,* Heng said.

The examination: See p. 44.

Heng looked at Rattana's leg: The thigh was very swollen. Both feet were cold and pale, but the right foot and lower leg were colder than the left. Heng examined the wounds at the thigh, put his finger into the lower of the two big wounds. *The wound track points towards the main artery of the limb,* he said.

Heng concluded: *Rattana has lost a lot of blood from the fracture and even more from an injury to the artery. I think he is still bleeding inside the limb because he is so cold.*



Ketamine anesthesia: See p. 104.

How they stopped the bleeding

Due to the heavy rain, they could not take Rattana to hospital until the next morning. *First we pack the thigh wound, then we warm him,* Heng said. Rattana's arm veins were collapsed. Heng placed a cannula in the external jugular vein. Then he slowly gave Rattana an injection of 100 mg ketamine IV, and one mg atropine IV. *Let me squeeze the infusion bag while you fetch some hot water,* he told Bun Set.

After two liters of warm Ringer, Rattana's heart rate came down to 100/minute. *Gauze packs ready, elastic bandages ready – let's start,* Heng said. The thigh wound track was narrow, so Heng split the fascia 5 cm upward and downward from the wound. He explored the wound track with his fingers. Deep inside he felt bone fragments and a big wound cavity. He withdrew his fingers, a few dark blood clots came out from the wound track. And then it started to bleed, massive bleeding, fresh red blood.

Leave the infusion, press hard here in the groin! Heng gave orders in a low, tense voice. Bun Sat pressed the artery and lifted the leg. Rattana moaned while Heng carefully packed the wound cavity from deep inside up to skin level with gauze bands. Then he applied elastic bandages tightly from the toes to the groin. *Continue to press in the groin at all times,* Heng told Bun Sat. After half an hour and another 1,000 mL of warm Ringer, Bun Sat carefully removed his fist from the groin. They both studied the dressing at the thigh: there were no signs of bleeding through. *Now go and inform Han's family, then try to get some sleep,* Heng said. *I'll stay with him through the night.*

Heng checked the breathing rate, pulse rate and blood pressure every 30 minutes throughout the night, and wrote the results on a sheet of paper. Heart rate around 100, blood pressure around 100 – Heng was satisfied. At sunrise, after a total of 5,000 mL warm Ringer and repeated injections of 20 mg ketamine IV, Heng took Rattana to the hospital in a pick-up taxi.

Stopping the bleeding and volume treatment: See p. 50-57.

Head injury in mine clearer

Sar Sothy was a professional mine clearer in one of the big mine-action NGOs in Cambodia. Clearing the vast mine belt along the Thai border, Sar had become familiar with the full range of blast mines. His team had cleared several versions of the Type 72, including the Chinese one with Motorola's anti-tilting device inside. Sar was afraid of the 72s. A slight tilting of the mine, for example by careless prodding, could make it explode. It was a booby trap designed to kill mine clearers.

More on blast mines: See p. 24-27.

This afternoon Sar had identified a mine. According to the safety rules, the other mine clearers would leave the field while Sar uncovered the mine. The medic Chon was also warned but didn't seem to take much notice – this team of mine clearers had never had accidents during the last two years. This Type 72 went off 50 cm from Sar's face while he was uncovering it from the soil. Sar was thrown backward by the blast. His helmet was blown off, and the face shield splintered. He was lying lifeless on his back when Chon and the team leader ran towards him.

The team leader stopped Chon: *Wait, there may be more mines around!* The team leader used a metal detector to search the area: there were no signals. He then picked up Sar's feet and pulled him into a safe area. *Come on Chon, now you are the boss, and I will help.*

Rescue in a minefield: See p. 42.

Work systematically, Chon told himself. *Airways, breathing, circulation, then the injuries.* He looked at his watch, it was 3:10 p.m.

- Awake? Chon called Sar's name, there was no reaction. He pulled an ear and Sar grunted in pain. *Responds to pain only, there may be injury to the brain.*
- Airways and breathing: Sar was bleeding from the mouth. Chon immediately placed him in the recovery position. Chon used the suction apparatus to clear the throat but it was bleeding too much. *He may drown in his own blood. He needs an endotracheal tube.*

Systematic examination of the wounded: See p. 44.

Intubation in the minefield

Chon checked the laryngoscope. It worked. Sar was a small man, so he chose a tube size 7.5 with stylet. The syringe for inflating the tube balloon was ready, the stethoscope ready, and gauze to tie the tube ready. *Be ready with the suction,* he told the team leader. Chon packed dry gauze packs into the chin tear to reduce the bleeding, and introduced the laryngoscope while using the suction. He could not see anything because of the bright sunlight. He tore off his own shirt and placed it over his own and Sar's head. Now he could see. *Suction again! There are the vocal cords, give me the tube – thank you. There the tube is in!*

Also see case story on p. 88.

Chon inflated the tube cuff, checked the breathing sounds with the stethoscope, and tied the tube. Sar suddenly coughed, and a fine spray of blood came through the tube. Chon did suction through the tube, and then placed his ear to the tube and listened. *He is still breathing,* he said. The time was now 3:20.

Unsuccessful cannulation

Chon examined Sar once again:

- Airways: Chon packed gauze into the mouth around the tube to try to reduce the bleeding.
- Breathing rate – 35/minute. *That's high, it must be due to pain. I'll give him a small dose of ketamine.*
- Circulation – Heart rate around 100/minute. Blood pressure at 120 mm. *He has not lost much blood.*
- The injuries: There were a lot of small wounds on Sar's face. *Impossible to tell if they are superficial or deep,* Chon said. He tore open Sar's shirt and trousers: there were no other injuries.

Chon tried to place an IV cannula, but he failed – his hands were shivering too much. So he gave the ketamine IM instead, a dose of 75 mg.

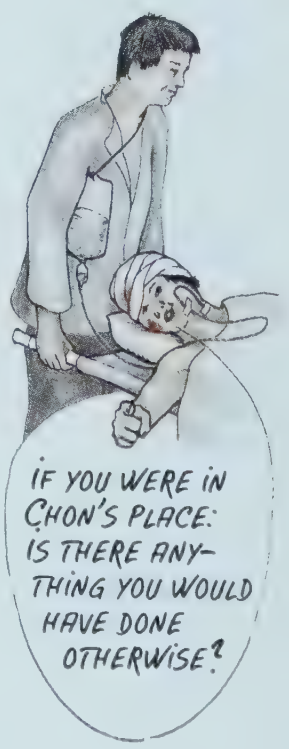
Drugs and doses: See p. 178-181.

Brain injury: close observation

There is nothing more for me to do here, Chon told the team leader. *15 minutes have passed since the injury, and Sar is still deeply unconscious. The brain is damaged, that is the main problem now. The cause may be a mine fragment that has entered through the face. Or a brain contusion due to the blast wave. Let's go to the hospital.*

They took Sar by ambulance to the hospital. On the way, every 10 minutes Chon checked Sar and wrote notes on a paper: *3:10, responds only to pain. 3:25 responds only to pain. 3:35, responds only to pain ... 4:15, responds only to pain. 4:25, hardly responds to pain.*

Go faster! Chon shouted to the driver. *Surgery is urgent!*



But Sar died

They reached the hospital at 7:30 p.m. The surgeon looked at Chon's notes and examined Sar: Endotracheal tube in the correct position. Breathing spontaneous but irregular. Heart rate 60/minute, systolic blood pressure 140 mm Hg. *Effect of the brain injury,* the surgeon said.

Now Sar did not react to pain at all. In both eyes the pupils were large. The surgeon shone a torch first at one pupil, then at the other. *Both pupils are wide open, none of them react to light,* he said. *Sar's brain is already dead. There is nothing we can do. For a severe injury to the brain like this, there is no cure.*

Abdominal bleeding

This is a story from Afghanistan. At sunrise, Nasi Gul (16 years) was carrying a big pot of water on her shoulder. She had walked this path from the canal to the village a thousand times, but this morning the track was slippery. She stumbled and had to take a side-step. That was when the mine exploded. A sudden pain in the belly, and she fell over. Five minutes later they ran with her to the small clinic run by the local "doctor", an experienced medic called Wares.

Medic Wares examines Nasi Gul

Nasi Gul was awake and vomiting blood. Wares started undressing her with permission from her father. There were only two wounds, both in the left flank. Breathing rate 35/minute, good breathing sounds on the stethoscope. Heart rate 120/minute, blood pressure 120 mm. *Give me two bags of Ringer, ketamine, and antibiotics,* Wares told his 14-year-old son. Wares placed two IV cannulas and told his son to squeeze the infusion bags hard. He gave 15 mg ketamine IV. *Start boiling the instruments and prepare a lot of hot water!* he called to his wife. *Nasi Gul may need surgery.*

Nasi Gul's father looked at Wares: *Surgery in this mud house? We must take her to the hospital!* Wares took the father to one side, and said to him: *My friend, even with the best horse, the hospital is one night distant. If she is bleeding inside, she will be dead on horseback before noon if I don't stop the bleeding. The life of your daughter is in my hands. Pray to Allah and trust me.*

Wares wrapped Nasi Gul in thick blankets. She had stopped vomiting by now. He wrapped the infusion bags in towels soaked in hot water, and gave Nasi Gul 2 g ampicillin and 1,500 mg metronidazole IV.

Damage control laparotomy

Wares checked Nasi Gul again: Airways OK. Breathing rate 25/minute, heart rate 140/minute, the blood pressure 90 mm Hg. Could the rapid heart rate be a result of pain? Wares gave her another 15 mg ketamine IV and waited for 5 minutes. Heart rate still around 140/minute – so it wasn't the pain, Nasi Gul was bleeding inside. Wares bent over her: *We have to operate on you, you are bleeding from wounds inside the belly. Be strong and don't fear, your father will stay with you all the time.* Wares was nervous, but still he felt confident: he had done life-saving laparotomies before, with Dr. Hans in the tent clinics in Jalalabad.

Signs of internal bleeding: See p. 55.

Last year Wares had trained his wife to assist him. Now he told her: *Place 5 bags of Ringer in a pot of warm water, and prepare the drugs. The starting dose will be 1 mg atropine, 2.5 mg diazepam, and 50 mg ketamine, – all IV.* Wares called Neaz, a young farmer, and told him to assist during the surgery. He explained to him the details of the operation while he prepared small and large gauze packs and placed the boiled instruments on a clean towel next to the bed. They both washed their hands in boiled water and soap for 10 minutes.

Ketamine anesthesia: See p. 104.

Wares washed the abdomen with soapy water, and cut through the skin exactly along the mid line from the tip of the breastbone to 10 cm below the umbilicus. He split the peritoneum – told Neaz to pull open the incision with his hands – and entered the abdominal cavity.

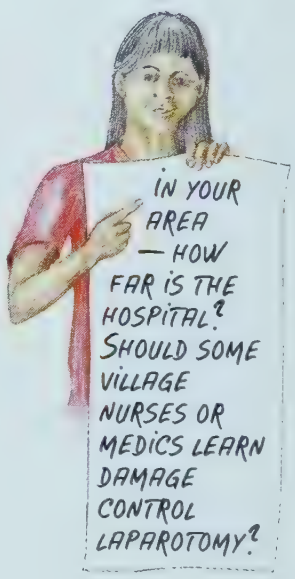
Stopping the bleeding

Blood was pooling to the left of the stomach. Wares removed five full cups of blood, clamped two arteries with small artery forceps – and the bleeding stopped. *One bleeding source stopped* he said to his wife. *Heart rate 130, blood pressure still at 90,* she answered. He examined the spleen: no injury. Wares placed one large gauze pack in the upper left quarter, and went for the upper right quarter.

Damage control laparotomy: See p. 94-97.

Here Wares found a 5-cm tear in the liver. It was not bleeding now, but he removed several cups of blood that had collected beneath the liver. *Don't touch that liver tear, Neaz, it may start bleeding again.* Wares carefully placed a lot of large gauze packs under and over the liver, around the tear. *The IV Ringers must be warm,* he told his wife. *They are,* she replied.

In the lower left side Wares found the inlet wound from the second fragment just in front of the colon. No blood there. No wounds in the colon. *2 liters of Ringer are finished, what now?* Wares' son asked. *Good boy! One more liter, moderate speed,* Wares replied. He checked the right side: no free blood and no blood collecting under the peritoneum.



I think we have stopped the bleeding. Let's see if the gut is leaking, Wares said. He felt confident now. They found two tears in the small intestine, and tied gauze band above and below the wounds. Before closing the abdomen, Wares again checked the liver tear, it was not bleeding now. In the left side the gauze pack was still dry and white. *Heart rate 130, BP 100,* his wife said. *Your daughter will survive,* Wares told the father. He left the gauze packs and the two artery forceps inside the abdomen and closed the mid-line cut.

Evacuation by tractor

Wares observed Nasi Gul closely for three hours after the laparotomy. With one Ringer infusion running slowly, the blood pressure was around 100 mm, and the heart rate at 100-120/minute. They placed Nasi Gul covered with blankets upon mattresses on a tractor-trailer. Wares sat at her head with his backpack full of infusions, ketamine, antibiotics, and his set of surgical instruments. Nasi Gul's mother held her hand firmly. Sixteen hours and 300 mg ketamine later, they arrived at the surgical hospital.

Three weeks later they went back home again, Nasi Gul sitting beside her mother on the trailer.

Severe injuries, no hospital

Salah was a young Lebanese farmer. While cultivating his land in the Bekaa valley, the plow hit a blast mine. His mule died on the spot. Salah's right leg was blown off below the knee and the inside of his left thigh received a fragment wound. He pressed both fists to his groin to reduce the bleeding and prayed to Allah to give him strength.

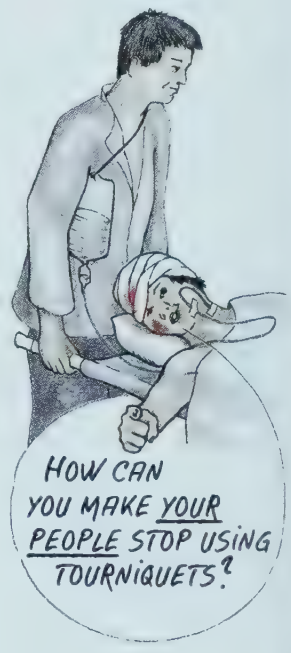
They found him 30 minutes after the accident, lying unconscious beside the dead mule. The villagers placed tourniquets of rope around both thighs and tied them as tight as they could. Salah moaned and vomited. Salah reached his village one hour after the injury, still unconscious. Salah's wife noticed that he was cold and wrapped him in blankets.

The medic removed the tourniquets

Hannah, a senior Hizbollah medic, came with the ambulance. She called Salah's name but he did not react. She pulled his mustache, Salah moaned, eyes still closed. Noting his gurgling breaths and bluish lips, she immediately placed him in the recovery position, placed an oral airway, and started cleaning the airway with a pedal suction. *What kind of men are you?* Hannah shouted angrily. *Do you want to drown this man in his own vomit?* She checked the lungs: she heard good breathing sounds on the stethoscope. She checked the circulation: cold skin, heart rate 140/minute, blood pressure around 70 mm Hg. All arm veins were collapsed. Hannah placed an external jugular IV cannula and told one bystander to squeeze one bag of normal saline infusion. She gave Salah 25 mg ketamine IV and started undressing him to examine his wounds. It took her one minute to find out that there were no other wounds than the amputation and the left thigh injury.

Prevent airway block from vomit: See p. 46 and 47.

The amputation wound was ragged and filled with dirt. Blood was dripping from it despite the tourniquet. The left thigh was very swollen and dark blood was running slowly from a 2-cm fragment wound on the inside of the thigh. *Look, all of you!* Hannah said. *Can't you see that tourniquets don't stop the bleeding even if this man has a very low blood pressure? Watch closely, and I will show you how to really stop the bleeding.* One helper elevated the right leg and another pressed on the right femoral artery while Hannah removed the tourniquet. The bleeding from the amputation wound did not increase. She packed the wound with gauze, and applied a compressive dressing with elastic bandages from the amputation up to the groin.



The artery injury

The infusion bag is empty, they shouted. Hannah set up another liter and told them to squeeze the bag. Then she went for Salah's left leg. Carefully she removed the tourniquet from the swollen thigh. The bleeding did not increase. She explored the wound track with her finger. A lot of dark blood clots came out of the wound. *Press on the artery here in the groin!* she ordered. *This is an artery injury. There is at least one liter of blood collecting inside the thigh. Keep pressing in the groin until I have packed the wound. Look how I do it: I fill the wound completely with dry gauze from the bottom up.* With a tight elastic bandage on the entire left limb, she told them to release the pressure on the artery. They all watched the thigh wound: it did not bleed through the bandage. Hannah had them promise never to use a tourniquet again.

She warmed the infusions by wrapping the infusion bags in towels soaked in hot water. She warmed Salah by putting Coca Cola bottles filled with hot water under the blankets. Four hours after the injury Salah had got 4 bags of Ringer. The heart rate was 110/minute, and the blood pressure 100 mm. Salah's skin was warm now. *We have just one problem left,* Hannah said. *The roads are blocked by the Israeli army, we cannot take him to the hospital.*

Methods of warming: See p. 56.

Fasciotomy in the village

Hannah had a set of surgical instruments stored in a plastic box containing 45% isopropanol. She showed one bystander how to keep the airway open, gave Salah 75 mg ketamine slowly IV together with 1 mg atropine IV. Hannah was ready for the fasciotomy.

Disinfection: See p. 106.

One helper pressed on the right femoral artery while Hannah undressed the limb. She held the muscle fascia in the amputation wound with forceps, and split the fascia with scissors at the back of the leg behind the tibial bone. She did the same at the front of the leg. She repacked the wound and applied elastic bandages, not very tightly this time.

Fasciotomy: See p. 100-103.

While one bystander continuously pressed on the artery at the groin, Hannah undressed and washed the left thigh for 5 minutes with soapy water. She did not remove the gauze pack in the wound on the inside of the thigh, but simply split the fascia 10 cm upward and downward from the wound. The fasciotomy wound hardly bled. She covered it with dry gauze and again applied the long circular dressing. It took her 10 minutes to do the fasciotomy.

Let's try to get a surgeon here, that artery needs repair, she said. *It's easier to get a surgeon through the checkpoints than a patient. I'll stay with Salah and care for him.*

The Hizbollah surgeon's evaluation

Three days after the injury, the surgeon finally came to see Salah and Hannah. Having heard Hannah's report and after examining the patient he said: *Hannah, this is close to perfect. The patient is in a stable state. There are no signs of pneumonia after he swallowed all that vomit. Congratulations with the fasciotomies! It is especially important to do fasciotomy early when there is an artery injury. The only problem is that the wounds are infected, so I cannot repair the artery. But he is young and strong. There is a possibility that his leg may survive if the deep femoral artery is uninjured. You have done well, Hannah,* he concluded.

Study the anatomy: See p. 210.

Improvised chest tube

They did not hear the helicopters until it was too late. Shirwan and his group of Kurdish guerillas had been in battle against Turkish soldiers for four days now. The Turks were having problems. Shirwan was tired but happy – until he saw the two helicopters enter the valley. He tried to take cover on the stony mountain side and was lying face down behind a big stone when he was hit. From the helicopter's doorway, one shot from the Turk's M16 entered Shirwan's right chest from behind. Shirwan was lying like one already dead. The Turks would register another "terrorist" killed.

The medic had no stethoscope

It took Shirwan's group three hours to take him to their headquarters. He was carried sitting in a "chair" made by two rifles and a leather jacket. The nearest hospital was on the Iranian side of the border, two days through the mountains. Shirwan could only survive that transport if he was in good shape. Now he was too weak.

Neazi received them at the makeshift clinic. Neazi was a veteran guerilla. After he lost one leg to a mine, he was working as a medic. *You've carried him sitting. That's the way to help him breathe,* Neazi said. *But he is wet and cold, start boiling water, lots of water! And fetch some blankets.* Shirwan was very weak. Neazi placed him in the recovery position, undressed him and examined him.

Open airway. Breathing rate 35/minute. Heart rate 140/minute. All limbs were cold. *He has lost a lot of blood,* Neazi said. There was a 1-cm entry wound from the bullet below the right scapula, and a 4-cm exit wound to the side of the right nipple. No blood came from the wounds. Neazi put his ear to Shirwan's chest, first at the right side, then at the left side. *Weak breathing sounds at the right side. Blood is collecting inside, there is a hemothorax,* he said. Neazi compressed the ribs, and could feel bone fragments. *And ribs are fractured,* he added. Neazi pressed gently against Shirwan's belly. *It's soft, that's good,* he said. He put his ear to Shirwan's belly and listened for at least one minute. *There are bowel sounds. So, the abdomen should be OK.*

To examine a chest-injured victim: See p. 48 and 90.

No chest tube

Neazi knew that job no. 1 was to drain the hemothorax. But he had no chest tubes. All he had left in his clinic were 2 liters of normal saline infusion, 10 vials of pentazocine, some syringes, IV cannulas, some suction catheters, one roll of gauze, tape, and some latex gloves. The suction catheters were too thin to drain the chest, 4 mm diameter only. *Try to find a soft plastic tube, 1-2 cm in diameter. Search every house in this village. And a sewing needle, the type used for leather. And some silk thread!*

Soon Shirwan's comrades came back with a plastic water tube, 1.5 cm in diameter. Neazi cut 1.5 meter of the tube and boiled it for 10 minutes. He also boiled a knife and the sewing needles. Neazi placed an IV cannula, started on the first liter of infusion, and gave Shirwan 45 mg pentazocine IV.

After washing his hands for 5 minutes, Neazi cut some side-holes at one end of the tube. He had no clamps so he asked his assistants to bend the other tube end to prevent air from entering the tube. Then he made a small skin cut in the chest below the right armpit. He used the point of the knife to penetrate the pleura, tunneled a track with a finger into the chest cavity – and placed the tube 20 cm upward inside the chest wall. He placed the other end of the tube into a bottle on the floor filled with soapy water. He then closed the wound with the sewing needle and silk sutures, and fixed the drain with adhesive tape. They placed Shirwan in a half-sitting position, and could see blood from the hemothorax flowing slowly down the tube into the bottle. Neazi put two bottles of hot water under the blankets, one in each of Shirwan's armpits. He ordered them to change the warm bottles every hour.

Chest tube drain : See p. 48 and p. 90.

No proper stomach tube

Next problem: We should get him to breathe forcefully, that will squeeze out his hemothorax, Neazi said. *But because he is so weak we will first have to replace the blood loss. One more liter of infusion will not be enough. He must have something to drink.*

However, Shirwan was still unconscious, he could not drink by himself. So, a stomach tube was necessary! Neazi had no stomach tubes, so he decided to try a suction catheter. It was short, only 50 cm, so he introduced it into Shirwan's mouth. With the catheter fully introduced, Neazi placed his ear to Shirwan's stomach, asked one assistant to blow air through the catheter – and was happy to hear air bubbling. Neazi fixed the catheter to Shirwan's lip with a silk suture. For the next six hours they gave Shirwan 50 mL – every 10 minutes – of warm soup. They tried to give more fluid, but then he vomited.

After six hours – and two liters of soup – Shirwan's heart rate was down to 100/minute. And he woke up. With pentazocine pain relief he was now able to blow "balloons" with the latex gloves. They could see that with every forceful breath he pushed out blood through the chest tube.

And no IV antibiotics

Neazi had no antibiotics left. But an old man in the village, who had tuberculosis, offered him some vials of streptomycin. Neazi gave Shirwan a double dose, 1 g IM every 12 hours.

Streptomycin cannot be used IV, only IM. Other antibiotics: See p. 178.

Twenty-four hours after the injury they had drained out 1.5 liters through the chest tube. Shirwan felt better so Neazi removed the stomach tube and gave him warm soup to drink, 4 liters a day. On the third day they carried Shirwan across the border. He sat on a horse together with a comrade. Neazi walked beside the horse carrying the bottle with the chest tube drain. On the fifth day, in the base camp hospital, chest X-rays showed that the hemothorax was drained and the right lung fully expanded. Shirwan had no fever so the doctors removed the chest drain.

Angola: bus hits an anti-tank mine

Our roads are mined.

A bus with 14 passengers hit an anti-tank mine on the outskirts of Luena, the provincial capital in Moxico, Angola. The ambulance from Luena hospital with an experienced nurse, Julio, arrived at the site 30 minutes after the explosion. Julio found the bus had been thrown 10 meters off the road. A crowd of people swarmed around the wreck. When he left the ambulance Julio noticed the smell of burning oil and burnt flesh. He said to himself: *Stay cool! I will make the three rounds. And I will work slowly. With this crowd of people running around, there can be no more mines.*

Prepare yourself for a tough job: See p. 40.

Collect information

Julio approached a group of four bystanders: *I'm from the hospital. Please, follow me, be my helpers.* They agreed, and told him that there were 14 passengers with the bus. *Five of them are dead already, we have collected them there at the roadside. One child is trapped inside the wreck, we cannot get him out. Also three others are injured. The other five are OK, they are sitting over there.*

Julio made a plan: *14 all together. Five are not injured, I will talk to them later. I have to check if the five really are dead. The four who are injured and alive will be my main job.*

First round: Airways and breathing

Julio's helpers shouted to the crowd: *Julio is here, he can help us. Get to the side!* First Julio checked the breathing and carotic pulse of the five dead victims lying by the roadside: *Yes, they are dead. We will leave them here.* Then Julio started on his first round, the helpers following him closely.

Mass casualties: See p. 70.

Antonio, adult male, was lying on the ground moaning: *Help me, I have pain!* His face, the whole front of his body, arms and legs were burnt. Julio placed Antonio in a half-sitting position to ease his breathing, and went for the next injured.

How many % is this burn? See p. 74.

Roberto, male, around 15 years old: His clothes and face were all bloody and covered with oil. *I am dying, I am dying!* he shouted. Julio tore off his clothes and wiped blood and dirt off his body. There were multiple small wounds but not much bleeding. *You are not going to die, my boy. I will come back to you later,* Julio told him.

Maria, adult woman, was lying on her side in the grass. *Are you pregnant?* Julio asked. *Yes, 8 months,* she whispered. Julio could see no wounds, but she was pale and was breathing rapidly.

Pregnant victims: See p. 59.

Andres, boy, 8 years old: Both his thighs were trapped between the seats inside the bus and were obviously fractured. Julio could see no other wounds. *Don't pull on me, it hurts!* Andres cried. Julio gave him 25 mg ketamine IM and told one helper to sit with the boy and comfort him.

Children in pain: See p. 62.

Second round: IV infusions and ketamine

Antonio: *He cannot survive this extensive burn,* Julio thought. *But he needs something for his pain.* Julio gave him 75 mg ketamine IM.

Roberto was still crying. His arms and legs were warm. *He is strong, he'll make it,* Julio said.

Maria looked anxiously at him. *You'll make it sister,* he said. Her arms and legs were cold. Julio placed two IV cannulas, each with 1,000 Ringer, and told two of his helpers to stay with her and squeeze the infusion bags. *Call me when the bags are empty,* he told the helper.

Andres, the boy was crying quietly. Julio felt the tip of his nose, it was cold, and so were the arms. Julio placed a large-bore cannula in an arm vein and started a flush infusion of 1 L of Ringer. *We'll take you out soon,* he told the boy as he gave him 5 mg ketamine IV.

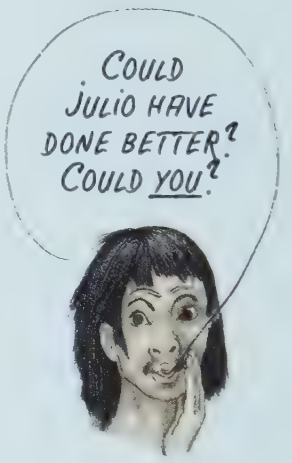
Third round: Find "patient no. 1"

Julio paused, looked at the four victims, and made this decision:
Patient no. 1 is Maria: *She is bleeding inside. If we push the infusions, the hospital may at least save her baby.*
Patient no. 2 will be Andres: *He has lost a lot of blood inside the fractured legs. We'll get him out and send him with Maria to the hospital first.*
Roberto seems strong, *breathing and circulation OK – he can wait.*
Antonio *will probably die after some days, but needs pain relief.*

Documentation and transport

Maria: Julio started another 2 L of Ringer infusions and gave her 10 mg ketamine IV. He wrote on a piece of paper: *Maria, 20 yrs. Pregnant 8 months. Internal bleeding. 9:45 a.m.: HR 140, BP 80, Ringer 2 L + 2 L, 10 mg ketamine.* They took Maria to the ambulance. Julio's note was taped to her dress.

Andres was calm now although still trapped. Heart rate 160 after 1 L of Ringer. *160 is too much for his age, he has lost a lot of blood,* Julio said. Andres got another 500 mL Ringer and 10 mg ketamine IV before they got him out of the wreck. He left with the ambulance together with Maria.



Roberto was still awake and crying. Julio examined his wounds, they all seemed to be superficial. *Let's take him to the hospital for observation,* Julio said. He made a written report on Roberto too.

Antonio: Julio tried to place an IV line, but failed. He had never felt this tired. He took Antonio and Roberto to the hospital when the ambulance returned for the second time.

The outcome

Maria died on the operating table during the Cesarean section, but her baby survived. Andres is now playing football. Roberto left the hospital the next day. Antonio died one week after the accident. The surgeons honored Julio for his job.

Points to note – Section 5

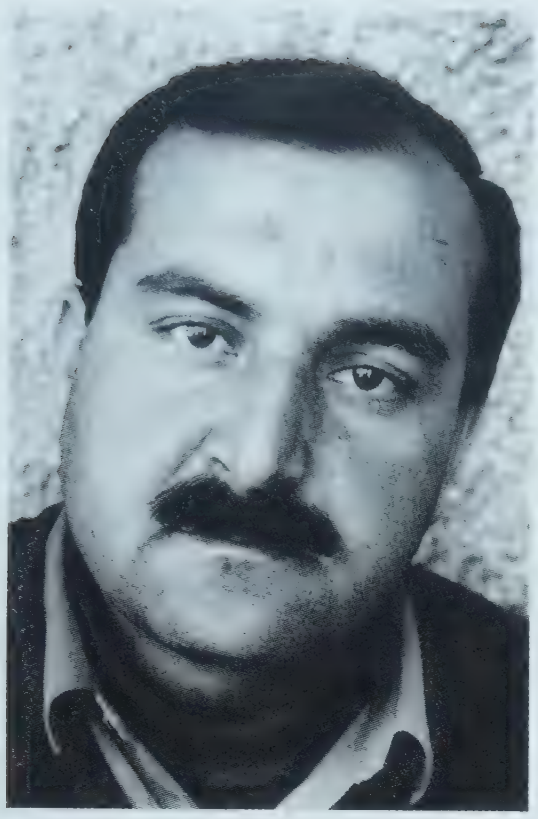
You can't do it alone

Life or death for the wounded depends on a chain of actions: from the neighbor helping to stop the bleeding, to professional life support from village medics, good care during the transport, and good surgery and care at the hospitals. To build a **chain of survival** is not an easy task. It cannot be done unless you work together with the local community and draw on their resources. Start by reading Osman's story on p. 128. The rest of Section 5 gives an outline on how to set up the chain of survival in your area. Training, equipment and costs are discussed in detail in Section 6.

Section 5:

The Chain of Survival

Osman, a life saver in Kurdistan



Osman Hama Salah.

My name is Osman Hama Salah, I am a mine medic. I am 30 years old, with a wife and 5 children. My birthplace is Aroza village in the mountains close to the Iranian border. My father is a farmer. I have treated 22 mine victims – one of them, a boy, died in my hands. Till this day I cannot forget that boy. Now I am working at the district hospital in Nal Parez, a small town not far from my home village.

The Village University opened my eyes

This area has a lot of mines left by the war between Iraq and Iran. In all the hills and mountains you can see from here, there are mines. In each village there are 10-20 people crippled from mine accidents. They have been injured – not because they are stupid – but because they are poor. They have to use this land for their animals. We have 3 months with snow, so the villagers also have to collect firewood. We cannot escape this problem.

Therefore the whole village was happy when I was invited to train with Trauma Care Foundation (TCF). TCF set up training courses – we call it a "Village University" – here at Nal Parez hospital. The Village University course was hard for me. We studied from early morning to late night – not only theory – but practical, useful things. We practiced on each other, on plastic dolls, and on animals. We did exactly the things we have to do on humans if they step on a mine. Now I have had 400 hours' training – I passed the final exams, and have a certificate signed by the Ministry of Health and our instructors saying that I am a mine medic. As an army nurse I already knew something about injuries, but this training has opened my eyes. Now I am confident and can do more both for mine victims and other injured persons.

Trauma Care Foundation: See p. 206.

The accident at Sarkan

Last fall one farmer and his son were collecting firewood when the father stepped on a mine. It happened 7 km from here up in the mountains. The villagers ran to the site when they heard the explosion, and they sent one man to call me. I grabbed my medical kit and ran towards the site. I met the villagers carrying the father on a stretcher they had made. The father had his hand blown off. He also had injuries to the face and could not see. He was breathing well, he could talk, but was very confused. The boy was uninjured, but could not speak. Till this day he still cannot speak. He is now 10 years old.

The villagers who carried the father had all attended a 2-day first aid course that I had taught in Sarkan village. They had done as I instructed them: Stopped the bleeding by packing the wound with clothes and placed a compressive dressing of elastic bandages. (I use to give elastic bandages to the most clever farmers at first aid courses.) We covered the victim with more clothes, and I placed two IV lines, gave ketamine and penicillin. Luckily a car passed by when we eventually came down to the road. We asked the passengers to get out so that we could take the victim to the surgical hospital in Suleimaniah. They agreed to this, and also took the boy who could not talk back to his village. Villagers have a strong spirit of cooperation in a crisis like

this. The father is doing well now. He can still do some farming, and after several eye operations he can see again.

Osman's Chain of Survival

When the villagers meet, in the mosque or at the market, they get news about accidents like this one at Sarkan. They hear that the "first helpers" were able to stop the bleeding and save the life of the farmer. Then the anjumans, the village leaders, come to me and say: *Osman, why don't you come to our village to train us?* So I go to villages far from roads where there are many mines. I call the villagers together and tell them that everybody who wants to attend a 2-day training course should come the next day. All of them say yes. I select 20 of them.

When they come and sit down around me, most of them are tired. I wake them up by telling a story: *A mother is preparing food in her kitchen. Her baby is lying on the floor. Suddenly she hears a sound from the baby, turns around and can see that the baby is lying still with eyes wide open and has stopped breathing. She runs to the hospital with the baby – who is already dead. The doctor places the baby on his arm and slaps it in the back. A small piece of tomato comes out of the baby's mouth. If the mother had known what to do, the baby would have been alive today. But she didn't, and it died. So please, wake up so that you can learn what to do.*

Training in basic first aid with Osman.

Then we train on each other: how to open the airways, how to stop the bleeding, why the injured must be kept warm, and so on. After 3-4 months I go back to each village to check that they have not forgotten what I taught them. The main thing is that they should be confident and trust themselves when they face difficulties. So far I have trained 280 villagers – men, women, and schoolchildren.

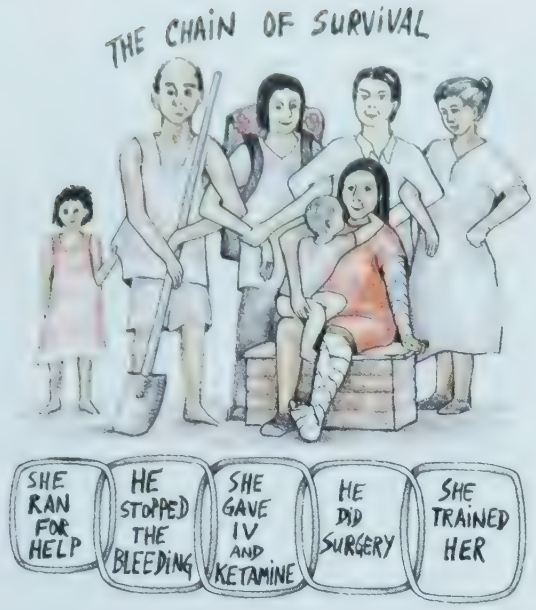
The most talented villagers are named first helpers. It's their duty to prepare some stretchers, gauze, and elastic bandages and store them in a place that everybody knows, like the mosque or the school. They have to run to the site whenever they hear a mine explode. We have agreed on how they should warn me about accidents.

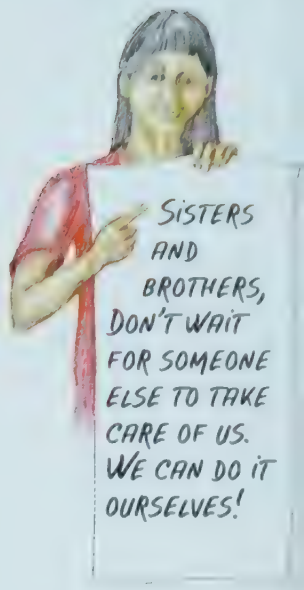
My salary is small, but the reward is big

I get US$40 each month as a mine medic. In fact I am also a supervisor, so I am also responsible for guiding the five other mine medics in this valley. When they have treated a mine victim, they come to me to discuss how they did. And I refill their kits according to the equipment they have used. There is a lot to do and much traveling. But to be able to save people in danger is like a great salary for me. Also my wife and my village are proud when we succeed.

We have a rule in TCF: The mine medics are not allowed to enter the minefields to extract the mine victims. My wife knows this rule, and she is very happy about it. You ought to have the same rule in other countries. A mine medic is too important to die young.

What is the Chain of Survival?





All the people who one after the other help the mine victim to stay alive, from the site of injury to the hospital, form the backbone of the chain of survival. The chain of survival depends not only on these people but also on their skills, their equipment, and how they cooperate.

Warning system

Whenever there is a mine accident, the village "first helpers" should be called and get to the victim as soon as possible:

- Information: Everybody, children and adults, should know which of the people are trained as first helpers in the area.
- All villages should agree on using a signal system to alert the first helpers and the mine medic. It may be a series of gunshots, a signal from a torch, calling by radio or from the minaret, using the church bells, sending a messenger, etc.

Village first helpers

Life-saving first aid must start within 30 minutes after the injury.

- Enough first helpers must be trained. There should be one first helper from each group of men, women or children to go into a risky area.
- Each first helper should know the basic tools for airways, breathing, and how to stop the bleeding.
- Each first helper should have 5 rolls of elastic bandage.

Training village first helpers: See p. 166-171.

Cambodian village first helper.

Transport to the village

Safe transport is more important than speedy transport.

- All villagers should know some basic things: Recovery position, how to carry someone with a bleeding face injury face-down, how to transport chest-injured victims in a half-sitting position.
- Also the villagers should know how to make their own stretchers from what is available.

Kurdish medics training at the Village University.

The mine medic

- The mine medic should get to the mine victim as soon as possible: Everybody should know who are the qualified mine medics of the area, and where to find them. There are two levels of mine medics depending on the skill they have: **(1) The Basic Medic** can give good life support for victims with light and moderate injuries (around 60% of all victims). **(2) The Advanced Medic** is better trained and can manage most mine victims
- The mine medics carry either basic or advanced medical kits. The kits contain enough drugs and infusions for 2-3 victims.

Training Basic Medics: See p. 152.
Training Advanced Medics: See p. 154-157.

Medical kits: See p. 164 and 190.

Transport to the hospital

In most cases the medic and the first helpers give such good treatment that the victim will be in a fair condition for at least 24-48 hours. Safe transport with good medical support is more important than speedy transport.

- The mine medic should follow severely injured all the way to the hospital, and give continuous treatment during the transport.
- At least one family member or a close friend should travel with the victim to the hospital and stay with him there.

- Prepare a car from the area as an ambulance with stretchers. The car should have blankets to warm the victims.
- If the hospital is more than 12 hours away, the victim needs nutrition along the way. Stores of nutritious food should be kept ready on the route.

Food for victims: See p. 162 and 183.

At the hospital

The life savers at different levels in the chain of survival should work closely together:

- The mine medic should not leave the victim until the hospital medical staff are present and have taken over responsibility for the victim.
- The mine medic should give an exact written report to the hospital staff.

Documentation

Exact medical documentation is necessary to check the quality of the chain of survival.

- The medic fills in the Injury Chart for all victims.
- The hospital doctors should fill in a Hospital Chart when the victim is discharged from the hospital. The victim takes the Hospital Chart to the mine medic who treated him.

Injury and Hospital Charts: See p. 80 and 172.

Sum-up of the accident

A serious accident badly affect the victim's family and the medic. To overcome this painful experience and be better able to support the victim and future victims, these steps are necessary:

- Back in the village the medic should give the family a true report as soon as possible and discuss how they can support the victim.
- The medic and the first helpers should meet to share their experiences and feelings when the job is done.

See more on p. 82.

Medical equipment – make it simple and cheap.

Maintenance

All tools need maintenance to work, so also do the elements of the chain of survival.

- Both medics and village first helpers need refresher training at least once a year.
- A fresh supply of medical kits and elastic bandages should be given to first helpers immediately after each accident.
- Back-up and support: Expert health workers should follow the chain-of-survival personnel continuously, to assess the quality of the medical treatment, to help collect records, arrange resupply of equipment, and help organize training courses.

Consumption and costs: See p. 140 and 164.

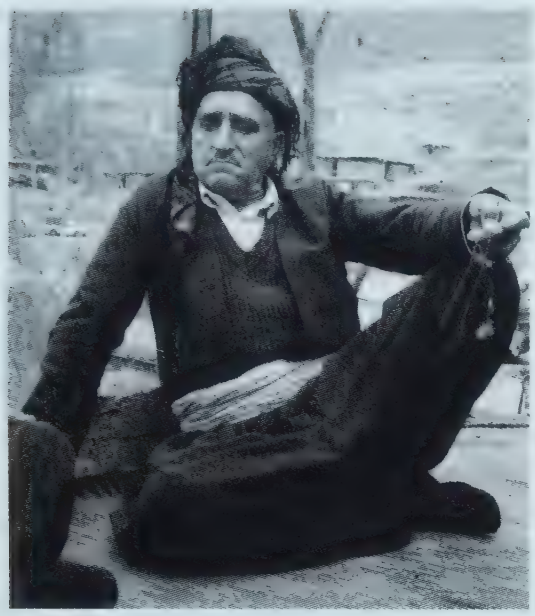
You should adapt these elements to fit the problems you have in **your** area. See next page.

Plan to build the chain of survival

It is a big job to build a chain of survival in a rural area: You have to involve the villagers, the clinics, and the surgical hospital. Mines differ, injuries differ, health care systems differ. So you cannot simply copy Osman's model from Kurdistan.

See Osman's story on p. 128.

The solving of any task in society must be done step by step. It is so for clearing a water canal, setting up a vaccination program, or building the chain of survival. For each step there are specific methods. Below is an outline of a plan consisting of three steps. The next five chapters discuss each of these steps.



We should do something!

Step one: Collect facts

In the mine-infested areas families say: *Too many are dying from mine injuries, we have all lost family members. The minefields will never be cleared. We should do something!* At this point people still don't know exactly what to do because the problem has not been examined. The true extent of the problem is not known. Families hurt by mine accidents don't like to talk about it. Information about these accidents is not exchanged between villages. The problem may be bigger than what people imagine, but each family can only see a small part of the whole picture.

But what exactly has to be done?

You don't know yet, because you don't have the true picture of the **whole** problem. First you have to make a record of people's experiences.

Mapping the mine injuries: See p. 134.

Map the mine injury problem – and the resources – in your area in order to
- find out why and where the mine victims die
- make the villagers aware of the problem.

Step two: Make a plan

As a result of mapping the mine injuries in your area, you know how many victims die – and where they die. You know the most common types of injuries. You know how long it takes to get the victims from the injury site to the village and further to the hospital – and who will help them along the way. You have moved from information based on each family's experiences to collective knowledge. This makes a sound base for action.

But there are difficulties

Maybe the villagers are still not ready for action. They may lack confidence in themselves, and say: *We can do nothing. We can hardly read and write. And even if we could do something, how could we afford it?* Or they may say: *These are matters for doctors, and you are not a real doctor.*
All objections and problems have to be discussed and solved before you can start action.

Arrange village meetings in order to
- unite the villagers on what can and should be done
- discuss objections and find solutions
- help the villagers realize that they can do it.

Planning:
See p. 136.

Step three: Action

Even the best mapping and planning of a project cannot prevent mistakes. When you are working with critically injured people, mistakes can kill. Serious mistakes during the starting period of a project can make the villagers turn their back on your work, saying: *That's what we said, these medical things are for real doctors, not for us poor village people.* Therefore you should first start a small-scale project, build one or two chains of survival from the mined areas to the hospital. Collect enough experience for two or three years before you expand the project.

A chain of survival for the villagers by the villagers. The Angolan medic Jacob with his neighbors.

Plan the Village University

The Village University is to train local health workers to form a chain of survival that responds to the needs in your area. The life support you teach them and the extent of the training depend on the local needs. Start training Basic Medics, and see how they do before you start training them as Advanced Medics.

The Village University:
See p. 138 and Section 6.

Start a project on a small-scale in order to prevent mistakes.

Good results: You should expand

Large areas may be mine infested. A handful of mine medics can help only a limited area. If the results are good, you should share your experiences for the benefit of other areas. Then select your best medics, train them as instructors, and let them train other medics as well as village first helpers. This method – letting one student train other students – is called "echo training". It helps you train hundreds of medics and first helpers.

Echo training:
See p. 166.

To learn from mistakes, documentation is essential

Real-life experience is our greatest teacher. Record the management of all mine victims carefully. Unless the injuries, the treatment, and the outcome are registered with absolute honesty or accuracy, you will not be able to identify mistakes. And without learning from the mistakes, how can you improve and make the small-scale project a good base for wider-scale action?

Go on to other areas if the results are good. On one condition: That you can prove the results are good.

Quality control:
See p. 172.

Mapping the mine injuries

Warning: You cannot rely on outsiders' statistics. Reports from UN and Western NGOs are made in the cities and register the survivors only – those dying at the site or on the way to the hospital are not included.

A good injury map can show you what kind of life support is needed in this area to save lives and limbs after an accident.

Let us look at two different case reports to see why we cannot use fixed standard programs for all countries alike.

Farmer Yat, anti-tank mine, Cambodia
Male 37 years. Left upper arm blown off in an anti-tank mine accident 11:00 a.m. Tourniquet in-field. Arrived at the district clinic 2:45 p.m. the same day on ox wagon, breathing rate 25/minute, systolic blood pressure 60 mm Hg, awake, still bleeding from the severed arm. Medic Lym Meng at the clinic removed the tourniquet, stopped the bleeding by gauze packing, gave 3 L warm Ringer IV, and ketamine for pain relief. A car ambulance took the medic and victim to Battambang surgical hospital. They arrived at 5:30 p.m. the same day, the victim in good shape. He was operated on the same night and discharged from hospital after 3 weeks without complications.

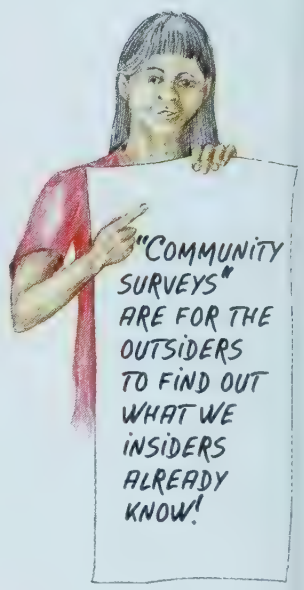
Farmer Antonio, frag mine, Angola
Male 45 years. Right lower leg blown off by a POMZ mine at noon. Rope tourniquet applied in-field did not stop the bleeding. Carried by villagers on bicycle 7 days to the nearest hospital, no IV infusion, no analgesia, no antibiotics in-field, no food along the way. On arrival at Lumege Hospital his breathing rate was 35/min, blood pressure 80, he was confused, fever 40° C, severe wound infection. He lost most of his leg, but miraculously survived thanks to his strong will to live.

See photo p. 33.

Ask nomads and soldiers.

Let insiders do the mapping

Villagers are fed up with health surveys. They have seen too many outsiders coming to do health surveys which lead to nothing. So they say: *Surveys for whom, for them or for us?* Mine victims and families who have lost some of their dear ones to the mines don't like to talk about their tragedies – especially not to outsiders. So, let some trusted person in each village do the mapping with you. And do not rush. Take the time you need to collect exact information.



WHAT TO LOOK FOR

1. **Which mines are the most common?** Mainly blast mines, mainly fragmentation mines, or anti-tank mines?

2. **Which areas have most mine accidents?** Some areas can have many mines but few accidents. Things can change when refugees come back to re-settle the area.

3. **How long did it take to get the victim from the site of injury to the village?** Register the means of transport and the costs.

4. **How long did it take to get the victim from the village to the hospital?** Register the means and costs of transport.

WHO TO ASK

1. **and 2.** Ask survivors, families of mine victims, farmers, women's organizations, nomads. Ask the local health workers. Also approach the army, especially senior officers and army medics. Draw a detailed geographical map of the area and put on the map minefields, mined roads, and the sites of all accidents.

3. **and 4.** These questions cannot be answered by simply reading a road map. You have to examine each case and note the time they took. There may be problems with security, in the rainy season bridges and roads are damaged, etc. When the time of evacuation is registered for all cases, calculate the average time of transport to the village, and further to the hospital for the rainy season (winter) and for the dry season (summer).

WHAT TO LOOK FOR	WHO TO ASK
5. What kind of injury? You can group the types of injuries like this: • light injuries • amputations • severe limb injuries but no amputation • severe injuries to the head, neck, chest, abdomen, or pelvis • child victims (age less than 15 years)	**5.** Ask mine victims who survived and their families. Ask village health workers. Get permission to study the files at commune clinics, district clinics and the hospital. Collect information from the army or from ex-soldiers.
6. Medical treatment outside hospital? • How many had first aid at the site of injury? Find out if tourniquets were used. • How many had medical assistance at the village? By whom? What kind of treatment – IV infusions, drugs? • How many had medical assistance during the transport to the hospital? By whom? What kind of treatment?	**6.** Ask surviving mine victims and their families. Check that information with local clinics and hospital files. Note especially local health workers who managed many mine victims and those with special medical skills. These people should be your students when the Village University is set up.
7. What was the outcome? • How many died in the field before getting any medical assistance? How long (hours) did they take to die after the injury? • How many died at local clinics, or during transport to the hospital? How long after the injury did they take to die? • How many victims died at the hospital? • For the amputees who survived: At which level of the limb did the mine blow off, and at which level did the surgeon amputate? • How many of the amputees got an artificial limb? • How many victims had wound infections at the hospital or later on?	**7.** Ask mine victims and their families. Ask clinic and hospital staff. Check clinic and hospital files. In most areas 35-50% of mine victims die before getting to the hospital. If you come out with a death rate of 20% or less, there are probably some mine fatalities that you have not recorded.
8. Does malnutrition or disease add to the problem? Register diseases that are widespread in the area. Find out if there is shortage of food or malnutrition in the area.	**8.** Ask the villagers, especially women and midwives. Ask local health workers and clinics.

Study the map. Use it at village meetings

Do particular types of mines kill more than other mines?
Is the death rate higher when the injury happens far from the village?
Is the outcome better in areas where they have local clinics?
What types of injuries have the highest death rate?

Setting up a local plan

Now you should have a map of your area showing where the mines are, and where the accidents happened. You have also plotted on the map the time needed for transport, and the medical treatment given in different villages and districts. You are ready to set up a plan.

Problem: Many mine victims die from blood loss in limb injuries before getting to the hospital.
→ Train a lot of first helpers in villages with mine problems to stop limb bleeding without using tourniquets.

Village first helper: See p. 168-171.

Problem: Many victims die from internal bleeding before reaching the hospital.
→ Village first helpers cannot do much for a chest or abdominal injury with internal bleeding. Train and equip Advanced Medics to place chest tubes. Train experienced health workers at local clinics to do damage control laparotomy.

Basic and Advanced Medics: See p. 152-157.

Problem: Most injuries happen far from the villages, many victims die in the mountains and forests.
→ Train lots of first helpers in the villages so that there always will be a first helper nearby when somebody is hit by a mine. Train medics in key villages, and work out a good signal system to call out the medics whenever there is an injury.

Problem: The hospital is far away, the transport takes several days, many victims die on the way.
→ Train advanced medics in villages at intervals along the route to the hospital. Also prepare and store supplies of IV fluid, drugs, and food along the route.

Problem: The mine injuries are not so bad. Still many die because they are already weakened by diseases and malnutrition
→ If the hospital is far off, the victims need food all the way during the transport. Train medics in villages along the route to the hospital to prepare food for the victims.

Food for victims: See p. 162.

Problem: Most amputees get to the hospital alive, but artificial limbs are not available so they cannot work as farmers any more.
→ Stop the use of tourniquets, as tourniquets are limb killers. If the hospital is more than 4 hours away from the injury site, train medics to do limb fasciotomies in-field.

Amputation problems: See p. 100.

Problem: Many mine accidents happen during mine clearing
→ Head and chest injuries are common in mine-clearing accidents. Train some members of the mine-clearing teams as Advanced Medics.

Problem: The fields are mined, but there are few accidents because the villagers have fled during recent wars. Now the refugees are returning to mined areas.
→ Train all people in the refugee camps in first aid before they return to live in the mined areas. Set up Village Universities in the refugee camps to train mine medics.

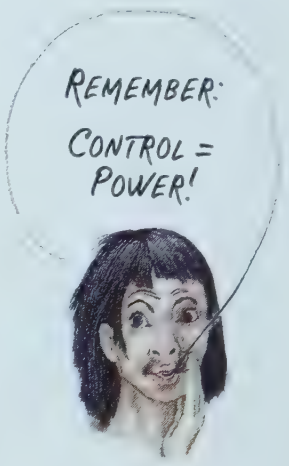
Problem: In many cases the mine victims cannot reach the surgical hospital due to bad roads, snow, or local fighting.
→ Train Advanced Medics from key villages in the area. These medics should also be trained in basic surgery to be able to repair the most common types of injury without sending the victims to the surgical hospital. As this is beyond the scope of our book, you should study manuals in war surgery.

See p. 204.

Problem: Many accidents happen when people try to get a victim out from a minefield
→ Trained medics should never enter a minefield. If there are no mine clearers around, train first helpers in the nearest villages on how to probe the ground for a safe route to the victim. They should always get the victims out to a safe area before starting life support.

Rescue from a minefield: See p. 42.

Can you maintain a Chain of Survival?



Sit in with the medical staff at local clinics and the surgical hospital. Discuss the local mine injury map with them, and why they should support the plan of building local chains of survival. Ask them to join you at village meetings, to become advisors. Also ask them to support requests for funding. But remember this: The Village University and the chain of survival can only work with the support of the rural population. Control by outsiders and city people may cause villagers to lose interest.

Calculate consumption and costs
You know how many injuries you can expect per month, what kind of treatment is necessary in the field and during transport to hospital. From these facts you can estimate how much medical equipment and drugs are needed. Then you know how much funding is necessary. Draw up a draft budget.

See more on p. 140 and 198.

Now you can arrange village meetings

The information you have gathered is not private, it belongs to the villagers who face the risk of mine injuries. They are the ones to select students for the Village University, the ones to support the training and the chain of survival. They have the right to share all your information and plans. The agenda for village meetings should include the following:

- The results of the mapping of local mine injuries
- How the local chain of survival will work
- The set-up of a Village University
- How to select students for the Village University
- Costs and funding
- Practical support from the villagers

Any information of a personal nature you have gathered about each victim should of course be kept confidential.

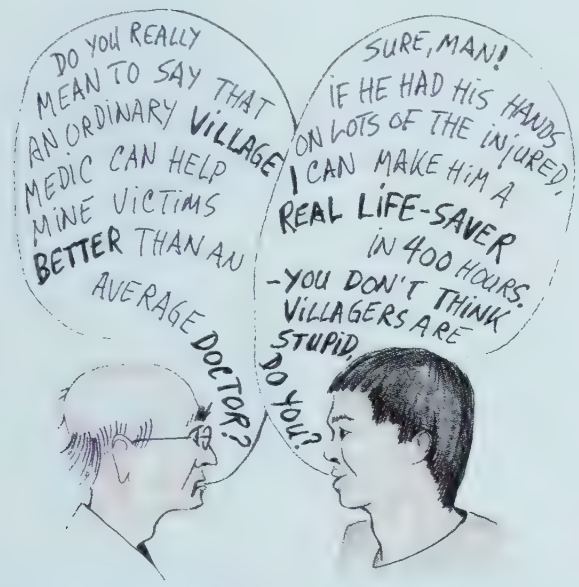
Why a Village University?

You are ready to hold village meetings to discuss how the chain of survival can be set up. At these meetings you should suggest to the villagers how local health workers should be trained to help more mine victims survive.

What is a "mine medic"?

The mine medic is the key person of the chain of survival. These are his three tasks:

1. **Treat!** He must get to the mine victim as soon as possible after the injury, and use his knowledge to save lives and limbs.
2. **Teach!** His skills are not his private property. He has to train other health workers to become mine medics. He also trains villagers to become first helpers.
3. **Organize!** He knows the local area and its mine problem. He is responsible for maintaining the chain of survival, organizing the supply of drugs, and the transport of mine victims.



Why a "University"?

Of course, poor farmers injured in minefields in undeveloped countries should have as much right to get good medical treatment as traffic accident victims in the rich countries. If this is to be so, the mine medics in the South should be as well trained as the North's graduate health workers in giving life-saving first aid to injured victims. At the Village University local health workers learn professional medical skills – exactly the same procedures that traditionally have been done by hospital doctors only. The practice and the studies in life support at a Village University should be as thorough and good as the training at any city university.

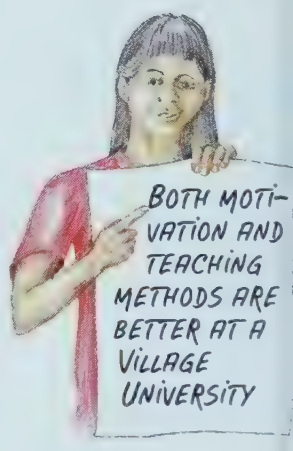
But why a university in a village?

The mine problem is basically a rural problem. Nurses and doctors born, trained, and living in the cities don't fully understand the impact of the mine problem. They work in high-tech medical systems – systems that cannot be applied in a poor rural setting. Therefore, the mine medic students should be villagers themselves.

The selection of students:
See p. 146.

The students learn more

We always learn better when we feel confident and at home. The Village University is not for learning in a professor's class. Instead, students actively take part both in setting up the university, and in the training. Such active participation by villagers is not possible in a city culture so different from their rural way of life.



A question of control

Most so-called "rural development programs" are run by outsiders, by city people. Seen through villagers' eyes, the results of these programs are often worse than zero. The villagers are made to think that they are ignorant and that only foreigners are clever enough. In that way villagers lose self-confidence, letting their areas come under control by outsiders. The mine medics in a local chain of survival should all be villagers. Those who suffer from the mine problem must be in charge of the chain of survival.

In 1994 a team of doctors went out from the cities and did a house-to-house survey in rural areas in Mozambique. This is their conclusion: "48% of mine victims in this area died. The figures are several times higher than suggested by hospital data. Our results suggest that the impact of land mines is substantially higher than originally thought."
Lancet 1995, vol. 346, p. 721.

Who knows the truth?

Most mine-action and medical NGOs are based in and funded by countries that produce and sell mines. They don't like to admit that the rates of death and mutilation from mine accidents are far higher than what their statistics show. Another reason for their "ignorance" is that most of these outsiders' statistics are based on hospital information. Most doctors and NGO experts live and work in cities – they never see the victims who die on the way to hospital. Their mine injury maps have large blank fields. The program for the Village University should be based on an exact and complete map.

The main difference is the teaching method

Learning in classes – or learning by doing?

In city universities the students try their best to swallow and reproduce what teachers tell them. At Village Universities students learn to understand what is taught by using it. The teacher is a guide, not a commander.

The lonely student – or teamwork?

In city universities the students are working beside each other, they do not learn to work together as a team. They compete to be the best student as seen through the professor's eyes and through their grades and marks. At Village Universities students learn to examine, discuss and solve problems together. A team of three is stronger than three separate individuals.

More on teaching methods: See p. 150-161.

TTING IDEAS INTO PEOPLES' HEADS
COPYING KNOWLEDGE
(AND MISTAKES)

What is "learning by doing"?

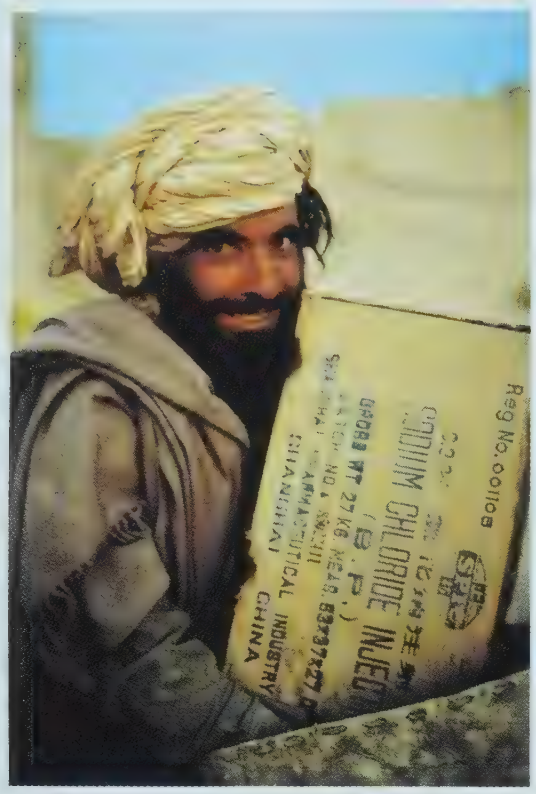
No mine injury is like another – they are all different. So, there can be no ready-made rules on how to manage each and every mine victim. The mine medic student must learn to be a problem-solver. To solve problems, three things are needed: Knowledge, practical skills, and using one's head to improvise. All practical sessions focus on real-life problems:

- One by one the students train in the details of practical life support on dummies, and on one another.
- Then students work together in groups on dummies, animals, and real-life victims.

Thinking, not copying

After closing the practical drills, the group and the teacher sum up what they did well or badly. Real-life cases treated by the students are discussed in group sessions. These continuous discussions of real case reports are the main source of medical knowledge and self-confidence at the Village University.

How much does it cost?



Afghanistan 1985.

Village first helpers

For each mine victim treated, at least 5 rolls of bandages and 3 x 1 m of gauze (or the equivalent in cotton cloth) are used.

Mine medics – consumption in 10 mine victims

IV cannulas	15
Suture	15 packs
IV infusion sets	10
Infusion Lactated Ringer	30 liters
Elastic bandage	25 rolls
Gauze	15 x 1 m
Adhesive tape	2 rolls
Inj. ketamine	500 mg
Inj. atropine 1 mg/mL	6 mL
Inj. diazepam 5 mg/mL	12 mL
Inj. penicillin	40 mega IU
Inj. ampicillin	6 g
Infusion metronidazole	3,000 mg (2 infusion bags)

Batteries, soap (or other disinfectant), oil (for instruments).

Transport and food

- Estimate the mean travel costs per mine victim (about 50% of all mine victims need hospital treatment).
- Set a daily rate for food and travel for the medics who follow mine victims to hospital.
- The victims need food if the transport takes more than 12 hours. Estimate the costs.

Materials and transport for one mine victim in Kurdistan and Cambodia cost US$8.

Medical kits

The medical kits are expensive, and must be in good order at any time. Run monthly checks: Remove expired drugs, infusions, and IV cannulas. Check that the packing of sterile equipment is not broken. Remove brittle tubes and instruments with rust. Plastic and rubber tubes should last three years, if stored dry. Clean and oil metal equipment and parts.

Medical kits: See p. 164 and 190.

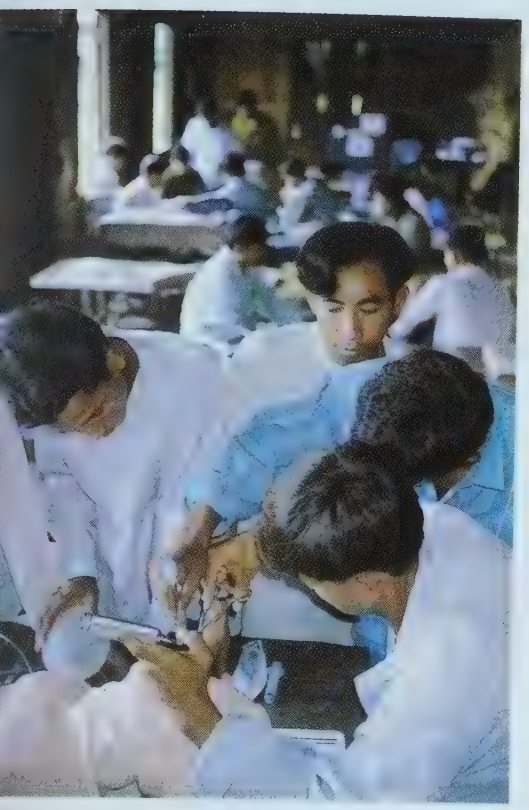
If you have a total of 20 medical kits, the contents of 1-2 kits are normally needed as resupply per year for damaged and lost equipment. So, you should purchase 22 kits to equip 20 medics.

Should medics have a salary?

A mine medic probably spends one week per month treating victims, looking after his equipment, studying, training, and teaching. It is a full-time duty for a back-up person to be in charge of 20 medics and 1,000 village first helpers. So, either they need a salary, or they should get food support and job assistance from fellow villagers. Bear in mind that "fat salaries make people lazy". High-cost programs are risky, and the question of salaries should be carefully discussed with health workers and local authorities before you set up a mine victim assistance program.

Why high-cost programs are risky: See p. 142 and 174.

The costs in job-hours



Monthly meetings to refresh medical skills. Training in endotracheal intubation. Cambodia 1997.

Monthly meetings

The mine medics should meet monthly for a one- or two-day meeting to improve the quality of the medical treatment:

- Evaluate case reports: Let each medic report on all the victims he has treated. The other medics should assess each case carefully.
- Medical lectures: Based on the case reports, point out "the victory of the month" (something done really well), and "the mistake of the month" (e.g. giving cold IV infusions to severely injured victims). From the lecture, the medics can learn from the victories and correct their mistakes.
- Refresher training: Live endotracheal intubation is seldom done in the field. Let all the medics practice endotracheal intubation on the dummy. Neck vein IV cannulation should be practiced if they have done only a few so far.
- Follow-up on teaching activities: Discuss any problems with the village training courses, find ways to improve the teaching, and plan the next month's teaching activities.
- Check-up on the organization: Resupply the medical kits. Cover travel costs and food allowance for the medics. Discuss any problems regarding the daily activities: transport, conflicts with local authorities, security problems and so on.

100 hours of refresher courses every year

The certificate of mine medics should not be renewed unless they attend yearly refresher courses. The yearly course should be a shorter version of the three courses at the Village University. From quality control studies you can find the main mistakes made in the medical treatment (see below). The refresher course should focus on these mistakes.

The three courses:
See p. 152-157.

Control the quality continuously

The back-up person should study all the Injury Charts and Hospital Charts, and register the outcome for all victims treated. At regular intervals he should present a review to the medics:

- How many victims die before we get at them?
- How many victims deteriorate during the evacuation?
- How many die in our hands before reaching the hospital?
- How many have infectious complications at the hospital?
- How many die at the hospital?

Compare with the results from the previous period: has the chain of survival improved?
Compare the results for each medic: what is the reason for some medics having poor results?
Compare with the results from colleagues in other provinces or countries: what are the reasons for differences?

More on quality control:
See p. 172.

The costs for education and refresher training are higher than the costs for medical treatment of victims.
But don't try to cut the training costs: That would compromise quality.

Funding the chain of survival

Outside funding is risky for the local community: Donors can strangle your program by deliberately stopping the money. Or they may insist that expensive professionals and medical high-tech from outside must be taken into your program – because local know-how and local methods are "not good enough". That simply means a foreign take-over.

Politics matter
Also see p. 174

How to reduce outside funding

- IV fluids are expensive. Use oral fluids instead of IV fluids, except for the urgent IV replacement of blood lost in severely bleeding victims.
- Choose cheap drugs and instruments: You can find good-quality, low-cost brands of most essential drugs and medical equipment from China, India, or Pakistan.
- Keep salaries low, stick to the village living standard. You can manage the job without expensive radios and 4-wheel-drive vehicles.
- Make your own teaching manuals. Take what you find useful in this book, translate it, modify it to fit the local setting, make copies of it at the market – and you have the teaching manual you need.
- Use fellow students, village people and local children for training instead of buying expensive training dummies. Raise your own animals for hands-on practice.
- Ask the villages to bear part of the food allowance or salary for the medics. Let them provide foodstuff for feeding solutions.

Oral volume treatment:
See p. 183.

Make it cheap:
See p. 190.

Animals for hands-on training:
See p. 158-161

Human models, not expensive dummies.

Generate your own income

- The mine medics will quickly become expert medical teachers. Offer low-priced training courses in basic life support to schools, workers' unions, military units, and high-price courses for rich NGOs.
- Locally made high-energy feeding solutions are excellent for children with diarrhea and patients with medical diseases. You have the knowledge to process and store foodstuffs. So why not develop standard low-priced packs with instructions on how to use them, and sell them at local markets?

Funding from local health authorities

Even in war-torn poor countries there is money in the cities. Go to the local authorities that administer UN programs for primary health care. As a local citizen you should have the right to know how much money they have got, and for what purpose. In a mine-infested country, the chain of survival you are running is definitely a part of primary health care. Claim your part of the funding – don't be modest! Approach offices that handle relations with big international relief NGOs. The local bureaucrats normally get pocket money from international relief programs (called "local administration costs") enough to run a few Village Universities. Demand your share!

Funding from rich countries and rich NGOs

Mine action is "in" now

Most rich countries store, produce, or distribute anti-personnel mines (as does Norway). However, the growing international attention on the land-mine epidemic troubles the mine-dealing nations. They do not like to assist you, but feel that they have to. So this is a good time to get funding for mine victim assistance programs like yours.

Establish your own NGO and request direct funding

Medical relief is big business: Big Western funders support mine action programs headed by big Western NGOs. These NGOs hire local staff to do the job for them. At least 60% of the total funding goes to maintain the NGO headquarters in the West and local headquarters in the program country. Maybe 40% reaches the poor local communities. The only way you can avoid this wastage of money is by registering your own local NGO. Then you can request direct funding from the big donors – without having to go through greedy NGOs.

Friendly NGOs may help you

Among the Western donors there is a deep mistrust of people "out there" in poor countries. It may help your request for financial help to have a formal recommendation from some Northern-based NGOs, and a project description that includes "external evaluation" by one of these NGOs. Note that this is not to let outsiders take control of your program, but to pay "lip-service" to arrogant Western funders in order to get at their money. We, the authors of this book, would be happy to assist you as consultants also in matters of funding.

Apply for funding the way "they" like it: See p. 198.

List of friendly NGOs: See p. 206.

UN with "double standards"

The good side

On one hand the UN agencies have made important contributions to world health. They are obliged by their charters and various declarations to assist you, as they state that *"health is a basic human right"*. UNICEF's 1995 report states that social progress *"is brought about less by governments than by people's movements"*.

And the bad

On the other hand the same agencies are under pressure from the rich countries in the North: USA provides 1/4 of UNICEF's and WHO's budget. The US government – the world's number one weapon-and-mine dealer – has used threats of sanctions and funding cuts in cases where UN agencies crossed its basic interests. And the UN agencies are part of the rich men's club themselves: Many top officials in those organizations previously held high posts in rich countries' governments and international corporations.

Squeeze them!

Approach the UN agencies to financially support your local mine victim assistance NGO. Refer to their nice statements and put them under friendly pressure to fund your chain of survival.

Points to note – Section 6

In this section we outline how we have trained health workers to manage mine injuries and other medical emergencies. Don't simply copy our ways and methods, but try to improve them.

What is good teaching?
Problem-solving is the main aim of health worker training. That is: learn to examine a problem carefully – find the main problem inside the problem – do something to solve the main problem – and examine again to see if you really succeeded in solving the problem. See more on p. 150.

Teacher, train new teachers
Our knowledge in life support is not private property. We should share that knowledge with villagers and refugees so that they can survive minefields, wars, and catastrophes they did not ask for. That is why medics also should be trained as teachers – to educate new medics, and to train a lot of village first helpers. See more on p. 166-171.

A chain of survival – for you or for them?
Who should be in charge of the chain of survival? Should it be the people living inside minefields – or outsiders? How can you be sure that the job you are doing is good enough? On p. 172-175 we discuss some touchy and important political problems.

Section 6:

The Village University

How to select students

Trusted by the villagers. Medic Hikmat with a village elder.

You have taken the step of having village meetings. The villagers probably approved your plan of setting up a chain of survival. They may well have had questions and proposals on how this could be done. Consider their proposals carefully – villagers seldom speak up unless they have something to say. At the same time you probably found the villagers were still unsure: They know that good plans alone do not change anything.

See p. 137-138.

The key to success

The key is to select the right people to become mine medics.

- They should be locals and live where the mines are.
- They should know what mine injuries really are from their own experience.
- They should be trusted by the villagers.
- They should know how to read, write, and calculate.
- There should be both women and men.

Select a group of not more than 25 students. It is harder to train a bigger group than that at the same time.

Geographical location

Map of mine injuries (green), transport times (red), and mine medics (red circles). Moxico, Eastern Angola.

Most students should be permanently living in the villages where most mine injuries occur. Or they should come from districts where you fear that future mine accidents will happen when refugees resettle and start farming in the mined fields.

Mapping mine injuries: See p. 134.

Look at the road map

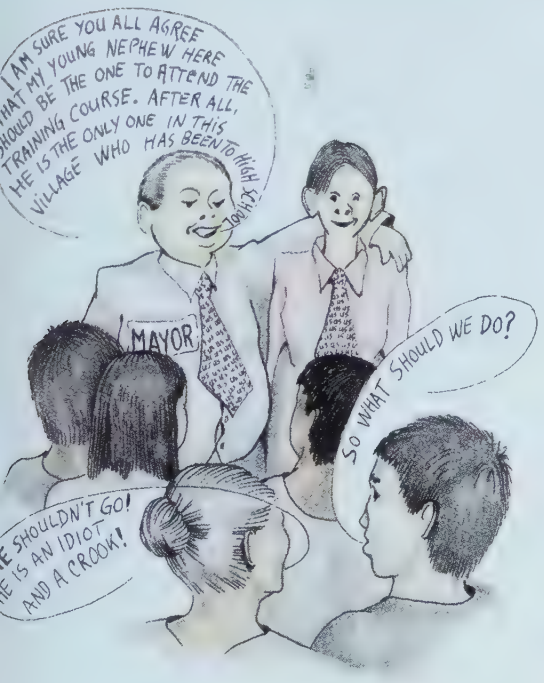
Mark the routes of transport for mine victims to the nearest surgical hospital. There should be mine medics staying along the main routes and at the main road intersections.

Look at the health services

- Basic level: If there are village health care workers, village clinics, or commune clinics in the mined districts, go there to interview the health workers. Maybe you can find some people who have had previous medical training. But note that previous training is not required for entry to the Village University. It is more important for students to have previous practical experience with mine injuries.
- Intermediate level: If there are district hospitals in the area, see if you can find one or two students from there.
- The surgical hospital: There should be one or two students from the surgical center, at best nurses or doctors from the emergency department.

Find the problem-solvers

It is easy to sit in a well-equipped hospital and make rules on how mine victims should be treated in the field. It is not so easy to manage a severely injured victim in the snow and freezing temperatures in the mountains of Kurdistan. So, look for people who really have had hands-on experience with mine victims. Who have had to improvise and solve lots of practical difficulties to get mine victims to the hospital. Theory can easily be learnt from books and classes – but not the ability to solve real-life problems.



Moral and political standing

Dr. Mudhafar, the head of TCF's chain of survival in Kurdistan, says: *Our students must be honest. They should speak "with one tongue only", that means treating everybody with kindness and respect. However, most people who consider themselves high-ranking and carry a syringe become arrogant and look down on common people. At the same time they are paying lip-service to their superiors. Such people are dangerous, they should not be allowed to carry even a single syringe.*

You get around students who are out for money and power if you select students in close cooperation with the villagers. A person who is trusted – not only by the village leaders and the local authorities, but also by the common villagers – is probably a good student.

Some formal skills are necessary

All students must be able to read and write well enough to read simple teaching materials and to fill in Injury Charts. They have to know some basic calculations to be able to use IV infusions and drugs correctly. Give the candidates some simple tests: *To relieve pain, a mine-injured victim should have 0.3 mg ketamine for each kg body weight. My weight is 70 kg. How much ketamine would you give me if I was injured?*

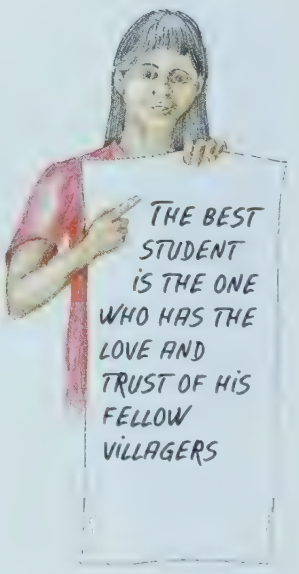
Injury Charts: See p. 80 and 227.

Gender

ender matters!

There are several reasons why all groups of students should have as many women as men:

- To treat: Students at the Village University are trained not only in mine victim assistance, but also in life-saving first aid for any injured victim. Women play a key role caring for the children and the family, and must get equal access to this knowledge. When it comes to practical first aid, a woman's skill with her fingers is often better than a man's. Besides, there are usually some women in each village who know about traditional medicine and nutrition. Their knowledge is needed at the training courses.
- To teach: The mine medic should train lots of village first helpers. At least 1/3 of the village first helpers should be women. They are better trained by female instructors.
- To organize: A mother understands better than most men what it means for her children and grandchildren to grow up in a minefield. Also, a mother of a big family who is also responsible for managing her home, has the practical experience to become a problem-solver.



Other factors to consider

The mine medic should have no "badge" or identification that makes it difficult for him to carry out his work, such as transport of victims across borders and checkpoints to the hospital. Such "badges" may be personal reputation, political, military or religious affiliation, or ethnic background.

Setting up the University

Guide the students step by step from simple life support to advanced life support. When one training course is over, there should be at least six months of treating mine victims and training villagers in first aid before you enter the next level of training. The experiences and results from this working period are evaluated when the next training course starts.

Village University, training course 1
Agenda: Simple life support
Duration: 100-150 hours

Working period at home
Agenda: Treat mine victims and train village first helpers
Duration: 6-12 months

Village University, training course 2
Agenda: Advanced life support (I)
Duration: 100-150 hours

Working period at home
Agenda: Treat mine victims, train village first helpers **and** train new mine medics
Duration: Life-long

Village University, training course 3
Agenda: Advanced life support (II)
Duration: 100-150 hours

Setting up a Village University in Karen State, Burma.

The classroom.

For the villagers, by the villagers

Let villagers help to plan, build, and run the university. It is their mine problem, their students, and their university. Choose a host village or a district hospital where the population supports your program.

Make it simple

Luxury distracts the mind. The Village University should not be like a luxury hotel. It should be a place where village students feel at home. Classrooms, tables, and operating rooms should be made simply and cheaply from local materials.

Classrooms should be big

Classes and practice (hands-on training) should be held together in the same room. Find or build a room big enough for both. The room should be airy with a dry and clean floor. Large bamboo huts or rooms at local clinics, mosques, churches, or schools will do. Good light is essential: big windows or huts with half-walls admit enough daylight. For the night sessions a small electric generator is useful.

Group work and circle training

The students should study, discuss, and work in groups of four or five. This helps them to learn how to solve problems collectively. There should be room for circle training: Set up 4-5 different "training stations" (e.g. CPR, head tilt-chin lift, recovery position, IV cannulation, how to stop the bleeding). Let the groups go from one station to the next. Prepare sheets of canvas or plastic to lay on the floor during the practice.

More on teaching methods: See p. 150 and 166.

he pig is in the cage, anesthesia
arts.

he operating room for practice
animals.

Store-room

Prepare a room to keep supplies of medical equipment, teaching aids and food. The room should be dry and dark.

Practice on animals

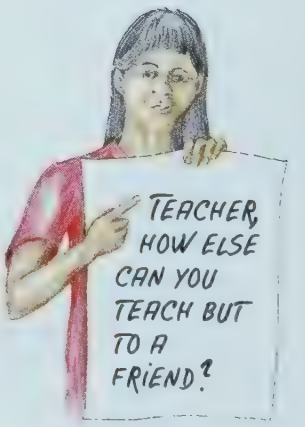
In training course no. 2 and 3 we train on animals under anesthesia. Pigs, dogs, goats, or monkeys can be used.

- **Animal care:** Build a pen in a quiet and clean place. Feed the animals well, give enough water, and protect them from the sun.
- **Anesthesia cage:** Make a wooden cage, size 1.5 x 1m. The floor should be clean and dry. The wooden bars help to restrain the animal after the first anesthesia injection is given.
- **Gallows:** The animal should be tied up with ropes in gallows and injured when under anesthesia. The animal should hang 1-1.5 m above the ground. A wall of sandbags or a slope without stones behind the gallows will stop the bullets from rebounding.
- **Operating room:** Build a hut with half-walls size 5 x 5 m. It should be big enough to allow two operating tables so that two groups can train at the same time. From outside the half-walls other students and villagers can follow the training. Cover the floor with dry sand. The operating tables are 1 m high. Make the table-top V-shaped to let blood drain from the table into buckets during surgery. For each operating table there should be two smaller tables, one for the anesthesia equipment and one for surgical instruments.

Training on animals:
See p. 158-161.

Facilities for the students

Students and teachers at the Village University should share living conditions with the local villagers. The students can stay with families in the village. In that way they get to know the villagers better, and the villagers will also become familiar with the Village University. Or, you can prepare large rooms for the students to stay in. Then they can study together, share experiences, and become a more united team.



Enough food, and good food

The weeks at the Village University mean hard work from early morning to late night. There should be three good meals per day. Fruit or sweets with tea or coffee during breaks are fuel for tired brains.

Hygiene

There should be strict rules of hygiene for students, as well as dummies, medical equipment, and animals. Locate the Village University where there is enough clean water.

You should be able to set up a Village University and run a two-week training course for 25 students for not more than US$2,000. If it costs more, you probably made it too complicated.

Advise to the teacher

Knowing theory alone has no value unless it can be used to change the world. Whether it is building a water canal or stopping the bleeding from an injured limb. The Village University's main goal is to solve problems in real life, not on the blackboard. The only indicator of success – for you as a teacher and for the students as mine medics – is good results in practical work.

More on teaching: See p. 138 and 166.

Teach your students how to solve problems

Step 4: Assess the effect of these measures, did you solve the main problem? If you did, what is the next important problem?

Step 3: Solve the main problem using the right life support measures

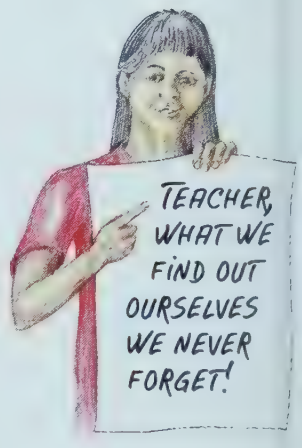
Step 2: Point out the victim's main problem

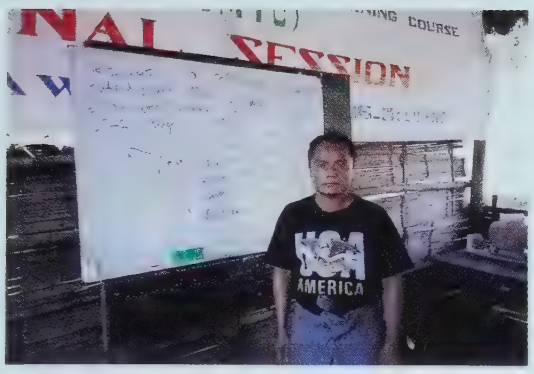
Step 1: Examine the victim carefully

The above is the action plan to solve problems. Repeat this plan during classes and practice. When you discuss real mine victim case reports, always ask the students: *What was the main problem in that mine victim? Find out if the life support you gave to him really solved the main problem.*

Collect case reports from the students

If possible, interview all students before the training session opens. Note the cases of mine victims they have managed and seen. Let each student prepare two case reports for class discussions.





Medic Ba Wah managed a war victim in the jungle. The class learned a lot from his reports.

Learn to know each student

Collect exact information from each student on the types of mines in his area, security problems, the local medical service, transport times and so on. This information helps you ask better questions. For example: *Raof, in your area where you have no ambulances, where the transport to the hospital takes five hours in the winter and the roads are bad – how would you prepare the transport of a victim in such conditions?* By linking your teaching to the students' own experiences, you encourage them to listen, think, and learn better.

Groups of 4-5 students

Divide the class in groups with students from different areas, different levels of skill and experience, with women and men together. Let each group elect a group leader. Have a 10-minute meeting with the group leader every morning to discuss problems and plan that day's activities.

Support each other, work in groups.

How to get a good start

Be friendly and humorous. Many students have good reason to be afraid of teachers. Encourage questions and discussion.

Let students present themselves

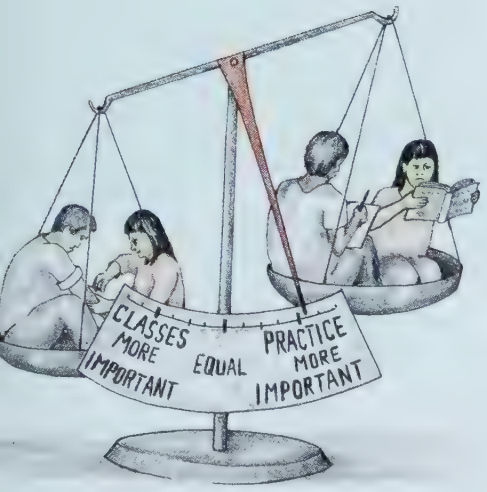
Make a round: let each student tell the class about his village, local mine problems, his experience with mine injuries, and what he expects to learn at the Village University.

Then go directly to practice

Make it clear that the goal is hands-on skill, not performances in theory: *The best student in this class is the one who can solve real-life problems.*

- For training course 1: Present a real-life case report on airway block. Then let the students train in airway control and recovery position in pairs.
- For training courses 2 and 3: Start with rehearsals of previous lessons. Let one student act as a mine victim. Let one group of students do the life support while the rest of the students evaluate their skills.

You can use the case stories on p. 46, 110, and 116.

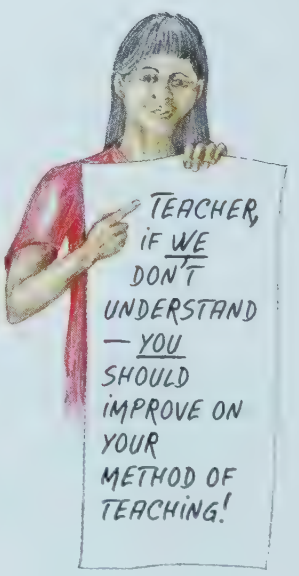


1/4 classes, 3/4 practice

The classes in theory should not take more than 1/4 of the total session, leaving 3/4 of the time for practice and discussion of cases. All classes should focus on the previous or the next practical session. Classes should not last for more than 45 minutes.

Questions and answers

Use two minutes at the end of each class and each practical lesson to get the students' opinion on how useful it was. Did the teacher use words they did not understand? Did the lesson give answers to problems they have at home? Target questions at the silent and the less experienced students. Take what they say seriously, and revise your plans accordingly.



"Three good points for each bad one"

Make it clear from the first day that each person attending the Village University will be monitored closely. That goes for the teachers as well as the students. There is no way to become skilled but to build on what was correct, and to correct what was wrong. The method therefore includes continuous review and self-assessment – which must not be mistaken for finding faults with one another. Emphasize what was also correctly done: For every mistake pointed out, you should also discuss three things that were well done.

Teacher, you are a role model

As a teacher you should be an example: Care for the well-being of each student, give encouragement and support. When mistakes are made, be exact and well founded in the critical comments you give.

First course: Simple life support

The first course is on simple life support, IV volume treatment, and ketamine pain relief.

In the second course we start training in advanced life support such as endotracheal intubation, ketamine anesthesia, chest tube drain, cannulation of the external jugular vein, and fasciotomy. See p. 154.

In the third course we either rehearse the first and second courses.
Or we train for damage control laparotomy (depending on how far you are from the surgical hospital), see p. 156.

Training in the recovery position. Angola 1997.

What to teach	How to teach
How mines damage • The amputation wound • The "hidden wound" • Fragment wounds to limbs and lungs.	Show the types of mines and fragments. Throw stones in water, to demonstrate the effect of fragment speed and size. Draw amputations and the anatomy of bones and arteries on your own leg and arm. Show the anatomy of a slaughtered animal: Cut carefully through the limbs to show the limb anatomy, especially how muscles are enclosed in separate fascia sections. Show the anatomy and action of larynx, lungs and diaphragm.
The response to injury • The intake and transport of oxygen: **A**irways, **B**reathing, **C**irculation. • Ways to increase oxygen delivery to the cells: Increased RR and HR. • Oxygen starvation: Types of airway block. • Oxygen starvation: Chest injury, and poor breathing due to pain. • Oxygen starvation: Blood loss. Signs of blood loss (skin temperature, HR, BP).	Classes: Our job is to help the body's own defenses. Place a candle under a glass and watch the flame die. *If I were to strangle you, for how long would you live?* Let the students run for 5 minutes, then take each other's RR, HR and BP (work in pairs). Study water canals and pumps to understand the blood circulation: • Much water, good flow. Less water, low flow. • No leaks, good flow. Major leaks, low flow. • High pump speed, good flow. Slow pump speed, low flow. Classes: Normal values for RR, HR, BP, and blood volume.
How to examine a mine victim • First, get the victim safely out of the minefield. • Then, examine **A**irways, **B**reathing, **C**irculation. • Then, find the main problem and start life support. • Then, re-assess the effect of the life support. • Then, take the weapon history and find all wounds and injuries.	Role-play: Place a student "mine victim" among disarmed mines. Draw wounds with a marker. Let a veteran soldier or mine clearer probe the ground to find a safe way to get to the victim so that you can take him or her to a safe place. Teach students how to examine the victim in a systematic way. Fill in the Field Injury Chart during the role-play (see p. 80).
Simple life support for airways • Recovery position • Head tilt – chin lift • Extraction of the tongue • Carry face-injured victim face down • Oral airway • Suction of airways.	Teach the exact technique with pairs of students practicing on each other, then with group circle practice (see p. 148). Explain the function, cleaning, and maintenance of suction apparatus.

good compressive dressing is ucial. Choot is training llagers, Cambodia 1998.

Simple life support for breathing • Half-sitting position • Pain relief • Stomach tube • Mouth-to-mouth rescue breathing.	Practice: How to position and carry chest-injured victims. The students place stomach tubes on each other. Rescue breathing: Use dummies or practice on fellow students (see p. 203). Classes: Ketamine pain relief, how to calculate doses (see p. 178 and pocket folder at back cover).
Simple life support for the circulation • Stop limb bleeding by lifting limb – pressing on the artery – packing the wound – compressive dressing. • IV cannulation on limbs. IV and oral volume treatment. • Prevent cooling. Ways of warming. • CPR in infants and adults. • Damage caused by tourniquets.	Students train in pairs and groups on how to apply exactly artery pressure and compressive dressing. Also ask children to act as "victims". Cover victims with blankets, use warm stones or bottles with hot water for warming. Train in IV cannulation on fellow students. Volume treatment: Learn from case stories how to assess volumes needed IV and by mouth.
Medical documentation Fill in Injury Charts and Hospital Charts.	Give case reports and let each student fill in the charts (see p. 80 and 172).
Prevent infection • Disinfection • Antibiotics.	Wash and disinfect equipment and instruments, use different methods (see p. 106). Calculate doses of antibiotics (see pocket folder at back cover).
Nutrition Make drinks and solutions for tube feeding based on local foodstuffs.	If the hospital is far away: Study local food processing and diets together with villagers. Set up a few high-energy standard solutions for feeding mine victims (see p. 163).
Teach village first helpers • Teaching aims • Teaching aids and methods.	Teach groups of women, men, and schoolchildren in neighboring villages (see p. 166-171).

Certification as Basic Mine Medics
At the end of the course you will know the students well, having watched them carefully throughout the training. You may let students pass with a certificate even if they have some trouble with the theory – but not if they do poorly in practice.

Before you end the course
Select a few of the best students as supervisors for the others. Make detailed arrangements on how to report treatment of victims and to get supplies of medical items. Also set up plans for training village first helpers. See more on p. 168.

Decide to meet monthly or every second month to revise the work and refresh practical skills. See more on p. 141.

Second course: Advanced life support – 1

In course no. 2 the students learn endotracheal intubation. For this, dummies must be used.

They also learn airway cut-down, chest tube placement, and fasciotomy. For these, they have to practice on animals under anesthesia. Animal ethics, care, and anesthesia: See p. 158.

What to teach	How to teach
Rehearsal of course no. 1 • How to examine a mine victim • Correct use of all simple life support measures • Correct use and maintenance of medical equipment.	Classes: Use 1-2 hours every day to let student discuss real cases they have treated since the previous course. Practice: Group circle training in simple life support measures (see p. 152) to check that all details are correctly performed. Check the quality of all medical kits. **Note:** Nobody should learn the advanced measures unless they have done the simple life support measures well.
Advanced life support for the airways • The anatomy of the larynx • Endotracheal intubation • Breathing bag-to-mask and bag-to-tube • Airway cut-down.	Study the anatomy carefully, using slaughtered animals and the airway dummy. Classes: All students must know by heart when intubation should be done, the risks of intubation and the equipment and preparations needed. Practice: Each student should do at least 20 intubations on the dummy. Airway cut-down is done on live animals (see below).
Chest injuries • The anatomy of chest and lungs • Examination and diagnosis of hemothorax and pneumothorax • Chest tube placement and drainage.	Demonstrate the anatomy using a live animal under anesthesia: Cut open the chest and make a mid-line laparotomy to show the anatomy and action of the heart, lungs, and diaphragm. The students examine each other and children from the village with percussion and stethoscope. Chest tube placement, tube suction, and drain are done on injured animals under anesthesia (see below).
Cannulation of the external jugular vein	The students practice on each other using a strictly sterile technique, closely supervised by the teacher.
Fasciotomy • Why and when • Fasciotomy on amputation stumps • Fasciotomy on the lower leg and the forearm.	The teacher demonstrates on live animals under anesthesia: The anatomy of the fascia section and how trapped muscle blocks major veins. The technique of fasciotomy and amputation stump fasciotomy is practiced on live, injured animals under anesthesia (see below).
Ketamine anesthesia • On animals (for training purposes) • On human mine victims for chest tube placement and fasciotomy.	Classes: Doses, monitoring, and complications Practice: On animals (see below).

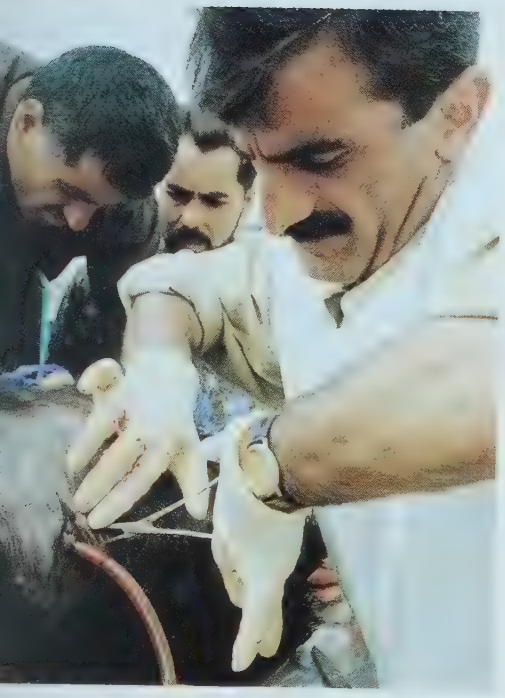
Airway dummy is necessary for training in intubation. Kurdistan 1997.

Surgical technique
- How the instruments are used
- Disinfection
- Maintenance of instruments
- Sutures and knots.

Agree on routines for disinfection, maintenance, and storin (see p. 106 and 190).
Practice on slaughtered animal: Cuts with scalpel and scissors. Skin sutures, and suture fixation of drains.

Life support for mass casualties

Classes: Discuss case reports where several people were injured at the time.
Role-play: Let the groups train in mass-casualty management with 2-4 students acting as "mine victims".



ebak is placing a chest tube for
e 10th time. The patient
goat) is under ketamine
esthesia and has already
other chest tube.

Simple and advanced life support for animals injured under anesthesia
- Giving anesthesia. Fill in anesthesia charts
- Simple life support measures
- Airway cut-down in face-injured cases
- Examination and diagnosis of chest injuries including diagnostic needle puncture of the chest
- Chest tube placement, suction, and underwater seal
- Fasciotomy.

One group gives the anesthesia and the life support, the other students watch and assess.

First, role-play in life support
When the animals are under anesthesia, they are injured in various ways – gunshot through both thighs, amputations, pistol shots through the mouth, stab wounds to the chest, pistol shots through the right chest etc. The injured animal is placed on the ground, and the student group is called *(Help, help!)*. Life support is done at the site with only one medical kit. When the life support at the site is completed (give a minimum of 20-40 minutes), the animal is carried on stretcher to "the village clinic" (operating hut). Here the condition is re-assessed and further life support given if necessary. The group gives a detailed plan on how they would evacuate this "mine victim" further to the hospital. Then, take a break for 5 minutes around the animal to discuss and assess the life support. See more on p. 160.

Second, practice life support measures
The animal is still alive and under anesthesia. The students train in pairs: Chest tube placement, fixation, suction, and underwater seal. (6 chest tubes can be placed on each side of the chest.) Fasciotomy. Suture technique.

Certification as Advanced Mine Medics
Advanced life support measures can damage – even kill – the patients if done incorrectly. Observe each student carefully during the course. Do **not** certify anybody for advanced life support unless he or she did well during the practice.

Before you end the course
- Evaluate all elements in the chain of survival – training of village first helpers, warning systems, patient transport, medical supplies: How did it work out during the previous working period? How did the supervisors do?
- Again, make detailed plans for training more village first helpers. Continue to meet monthly or every second month for refresher training (especially of endotracheal intubation), and to discuss mine victim case reports.

Third course: Advanced life support – 2

This is the final training course at the Village University, and concludes the education of mine medics. Depending on the local setting, you have to decide on the content of the third course:
If the surgical hospital is far away, use the third course to train students in damage control laparotomy for victims with severe abdominal and pelvic injuries. For this, the students have to practice on animals under anesthesia.
See more on p. 158-161.
If the transport time is less, the laparotomy can be done at the surgical hospital. Then you can use the third course to rehearse the training done in course no. 1 and 2.

If the hospital is far off, this mine victim will not survive unless damage control laparotomy is done at some rural clinic.

Note the clock: Not more than 45 minutes!

What to teach?	How to teach
Rehearsal of course no. 1 and 2 • How to examine a mine victim • Correct use of all basic life support measures • Correct use of endotracheal intubation, airway cut-down, chest tube drain, and fasciotomies • Correct use and maintenance of medical equipment.	Use the first part of this course to check the quality of the previous courses: • Classes, review and self-assessment: Study the outcome of mine victims treated by the students in the previous working period. Use 2 hours every day during the course to let students report on patients they have treated since course no. 2. • Practice: Group circle training on simple life support measures, endotracheal intubation, and cannulation of the external jugular vein to check that all details are correctly performed. • Let each group practice on at least one live animal with injuries to the airways and/or chest. • Check the quality of all medical kits. **Grade the students:** Damage control laparotomy is an advanced life support measure. Make a careful assessment of each student: Only students with a good medical understanding and technical skill should get training in damage control laparotomy. Students who do not have such qualities should not be dismissed: Let them follow the training as observers, but certify them only for less complicated life support measures.
The anatomy of the abdomen and the pelvis • The layers of the abdominal wall • The location and function of the abdominal organs • The main blood vessels and the blood supply to the organs • The four quadrants and the pelvic cavity.	Let the students study the anatomy in a slaughtered animal. Show the students why high-speed fragments to the abdomen normally damage more than one organ. Also demonstrate why fragment injuries to the lower part of the chest may damage both the lungs and abdominal organs.
Surgical instruments and techniques • The mid-line laparotomy cut • The routine for exploring the abdominal cavity • Clamping blood vessels with artery forceps • The technique of gauze packing to stop bleeding • Temporary closure of the abdomen.	The teacher demonstrates the surgical techniques slowly and step by step on a live animal under anesthesia. This is also an excellent opportunity to give a lecture on loss of heat: Let the animal have cold IV fluids only. Measure the rectal temperature of the animal during the demonstration. Let the students see how rapidly the rectal temperature drops when the abdomen is cut wide open. Conclusion: *This is why damage control laparotomy should not last for more than 45 minutes!*

Ehwah and Chitmong stop abdominal bleeding. Burma 1995.

Damage control laparotomy

- To conduct the anesthesia and fill in anesthesia chart
- To assess a victim with abdominal injury: Is it bleeding inside? And how much? Should damage control laparotomy be done in-field?
- The mid-line cut
- Find the bleeding source
- Stop the bleeding by packing with gauze
- Tie off leaks from intestinal wounds
- Temporary closure of the abdomen within 45 minutes
- Life support during transport to hospital.

As in course no. 2, each animal is used for two types of practice: First, role-play for one student group with the animal in place of a mine victim. Second, all students train on the animal in the technique of airway cut-down, chest tube placement, and fasciotomy.

Role-play, one group in action

The animal is under anesthesia, but not intubated. Make a thigh gunshot or chest stab wound. Then shoot the animal through the upper part of the abdomen with 9 mm pistol. Don't hit the kidneys or major blood vessels. Place the "victim" on the ground and call for the life support group. The students stop the bleeding from other injuries and place IV lines before the victim is carried to the "district clinic" (operating hut). At the "clinic", find out if damage control laparotomy has to be done: If the HR increases despite good anesthesia and a lot of warm IV fluid, damage control laparotomy should be done immediately (see anesthesia chart p. 159). Measure the time taken, the laparotomy should not be more than 45 minutes. When the abdomen is closed, warm IV infusions should be flushed in until the HR comes down to normal. The group makes its plan for further treatment during the transport to the hospital.

All students, learning by doing

Train the students in the techniques of other life support measures while the animal is still alive and under anesthesia.

Certification according to skills

Assess the skills of each student carefully. Of 20 students, maybe only five should be certified for damage control laparotomy. Consult local health authorities and the surgical hospital. More on certification and legal problems: See p. 174.

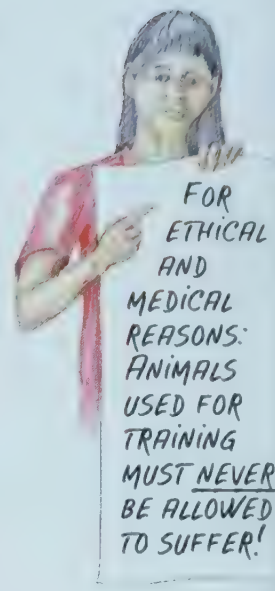
Before you end the course

- Sum up and assess the results of the previous working period. There are always things that can be improved. Continue to meet regularly to discuss case reports, study, and train. See p. 141.
- Don't forget: In life support, simple things are most important. So set up plans for training more village first helpers. See p. 168.
- Arrange a decent closing ceremony with the villagers and local authorities. Let the Village University students be the honored guests at the ceremony – they deserve it.

Anesthesia for animals

Welcome to the Village University!

Several types of animals are useful for hands-on training. Use what is available at a reasonable price. Training in venous cut-down and fasciotomy is best done on dogs, but pigs can take more injuries and heat loss than dogs. Don't use goats or sheep for laparotomy training, their abdominal anatomy is completely different from humans'. But they work well for other types of training. The anatomy of a dog's abdomen is closer to humans'.



Religious and cultural considerations

Discuss the need for this kind of training with village elders and religious heads, and ask their permission. Muslims find the use of pigs difficult. The dog is also regarded as "dirty". We have used dogs for training in Islamic areas without any problems once local religious heads understood the humanitarian purpose of the training.

Equipment and drugs for anesthesia

Endotracheal tubes no. 6, 7, and 8.
Stethoscope.
Ribbon gauze.
Self-inflating bag for assisted breathing. Suction apparatus and catheters.
Large artery forceps.
Syringes 2 mL and 10 mL.
Injection needles
1.5 mm x 50 mm.
IV cannulas.
5L Ringer.
Ketamine 50 mg/mL for IM, diluted to 10 mg/mL for IV use.
Atropine 1 mg/mL. Diazepam 5 mg/mL.

Use healthy animals. Treat them well

You will need at least 12 animals for one training course with four groups of students. Pigs should weigh 20-30 kg, dogs not less than 25 kg. The animals must be healthy and well fed. Prepare a quiet, shady, and dry pen for them. Tie up aggressive animals to prevent in-fighting. Unstressed animals that are well cared for have fewer complications during anesthesia. The students' "animal care group" should see that the animals have free access to clean water, are fed twice a day, and are not too cold or too warm.

Check the animal

The students training in life support on an animal must also be responsible for the anesthesia on that animal. Make an anesthesia chart. Assess the weight of the animal, measure the HR, RR, and body temperature (mouth) and fill them in the chart. The animal's stomach should be empty. Sheep and goats should have no food for 24 hours, no water the last 12 hours. Pigs and dogs: no food for the last 8 hours, but free access to water.

Starting the anesthesia

Use IM ketamine to start the anesthesia before hanging the animal up in the gallows. When the animal is shot, the "life support group" places IV cannulas and continues with IV ketamine anesthesia.

1. Prepare separate syringes with ketamine, Ringer, and atropine. Mark each syringe. Place the animal gently in the anesthesia cage. Use pen-poles to push it towards the wall so that it cannot move, see photo on p. 149.
2. Inject IM ketamine in the buttock. Give atropine through the same needle, and flush with some mL of Ringer.
3. Remove the needle, release the poles, and let the animal move freely. It will fall asleep within 5-15 minutes. Watch the airways: tilt the head by lifting the chin if the animal starts snoring.
4. Record the HR, RR, and the level of consciousness (does it react to pain?) every 5 minutes. The HR is measured by stethoscope, or by the pulse beat in the artery of the front or hind leg.
5. Clamp the tail firmly with a large artery forceps: The animal is ready for the gallows when it no longer reacts to pain with movements.
6. If the animal reacts to pain after 15 minutes, give more IM ketamine (half the starting dose). Add IM diazepam10-20 mg.

Recommended doses for anesthesia on pig, dog, sheep, and goat

Ketamine starting dose:
20 mg/kg IM.
Ketamine maintenance dose:
1-2 mg/kg IV.
Atropine: 1 mg IM/IV.
Diazepam: 10-20 mg IM or 5 mg IV.

Note: There is no such thing as fixed doses of ketamine. The correct dose is the dose necessary to take away all pain.

More on ketamine anesthesia: See p. 104.

Under anesthesia and ready for the gallows.

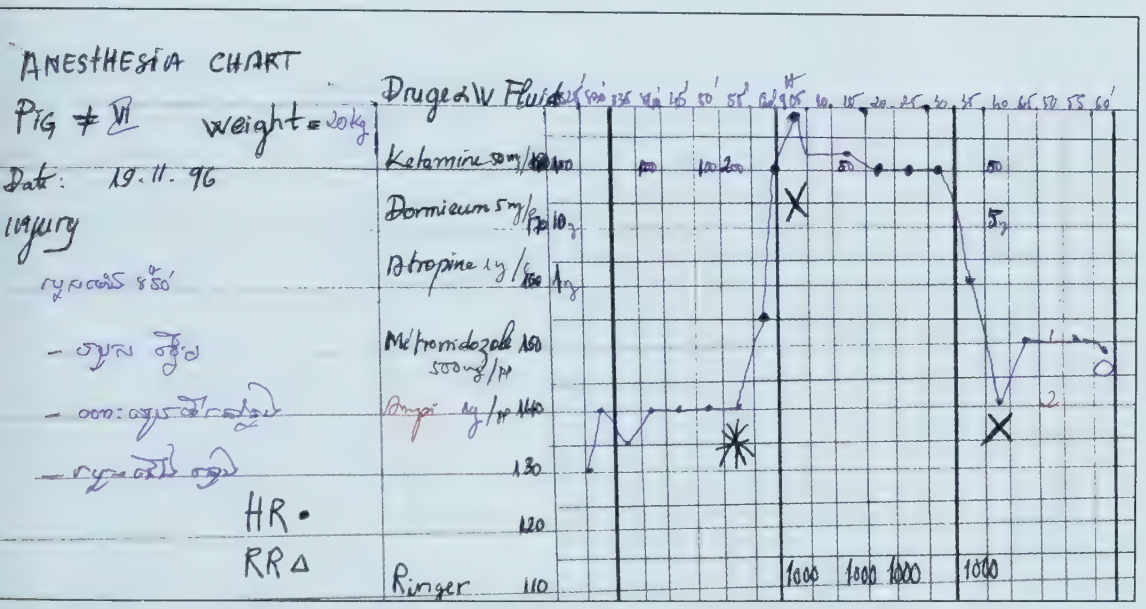
One 9 mm bullet or a few stab wounds.

No shooting before anesthesia is complete
Signs of discomfort when the animal is suspended in the gallows mean that the anesthesia is not sufficient. Repeat with half the starting dose of IM ketamine. Check by tail clamping again after 5 minutes.

Anesthesia during the training

IV cannulation: Use the ear veins in pigs. Use veins on the lower front leg, at the hind leg, or the external neck veins in dogs, sheep, and goats. Shave the area well, apply firm pressure on the vein to make it swell. "Pump" the footpads of dogs to see the veins.
Maintain the anesthesia: Give 1-2 mg/kg IV of ketamine every 10-15 minutes, or when the animal shows signs of discomfort. If you cannot place IV cannulas, continue with IM ketamine: 5 mg/kg every 20 minutes.
Watch the airways continuously: Bluish color of the tongue indicates oxygen starvation. If the airways are not free, apply traction to the tongue. Use suction to clear saliva from the airways. Do airway cut-down immediately if the airways are blocked by blood.
Keep the animal warm: Cover it with blankets and give warm IV infusions (42° C). Take the temperature in the mouth at intervals.
Use the Anesthesia Chart: Record the HR and RR every 5 minutes on the chart. If the HR is above normal, the blood volume is too low – or the animal has pain. If the animal's tongue is dry, the blood volume is far too low – flush in the IV infusions.

See case stories on the next page.



This is the Anesthesia Chart for pig no. 6 at a Burmese Village University. It was shot in the belly at 8:53 a.m. Ten minutes after the injury the HR increased from 140 to 190/minute – a heavy blood loss. The laparotomy was done in 35 minutes (X – X). After 4 L of Ringer the blood loss was compensated. The total dose of ketamine was 900 mg.

Enjoy the meat!

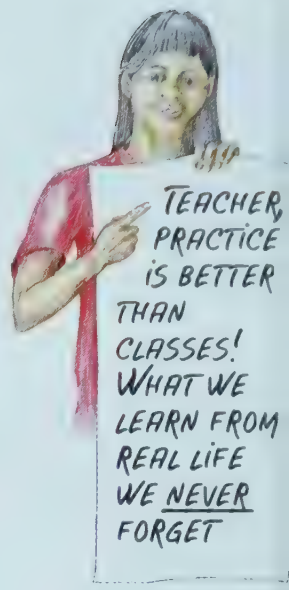
End of training
Each animal must be killed painlessly at the end of the training. You can bleed the animal to death with a stab wound in the neck artery. Dead dogs can spread infections and parasites: Bury them deeply and cover with stones. Other animals can be used for food.

Enjoy the meat!
The ketamine left in the animal meat will not affect a person who eats it. Make sure the animal is bled well before the meat is processed. Fried smoked meat flavored with curry-salt is a popular delicacy for villagers as well as for hard-working students.

Animal case stories

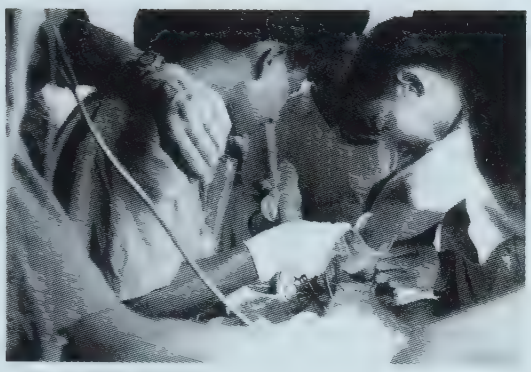
Pig with multiple injuries

A 30-kg well-anesthetized pig is shot with a 7.62 mm rifle through one thigh, and with a 9 mm pistol through the abdomen.



Advanced field life support

The training group is called and told: *Under that tree is a farmer hit by a POMZ 5 minutes ago. The village clinic is 10 minutes away, the nearest surgical hospital 3 days away.* The students rush to the victim. Two students stop the bleeding from the thigh wound, one does the IV cannulation. The group leader examines the victim: *Airways open, RR 30/minute, HR 120/minute. The breathing and HR is rapid. Is he in pain?* The teacher answers that the victim has no pain. *Then he is losing much blood, we need two IV lines, hurry up!* He finds the abdominal inlet wound on the left side – but where is the outlet wound? There! In the back part of the right chest. *It must be a hemothorax here. Please be quiet while I examine the chest!* He finds weak breathing sounds on the left side, inserts a chest tube, connects the suction, and draws 200 mL blood through the tube. Fifteen minutes after the injury they carry the victim to the bamboo operating hut.



Damage control laparotomy at "the clinic"

Now the HR is 150/minute. The limb wound does not bleed. *He is still losing blood, we must do an urgent laparotomy! Please give him 50 mg ketamine IV!* Two minutes later the abdomen is split open. They find the right upper quadrant filled with blood. One student immediately clamps the main blood vessels to the liver with his hand (see drawing p. 97). They find a large tear in the right part of the liver, but no other major sources of bleeding. The group decides to wait for 10 minutes while finger clamping the liver vessels. They give warm IV infusions in both lines. Ten minutes later the HR has dropped to 110. They pack the liver tear carefully with gauze and place large gauze packs around the liver. *Release finger clamping and press on the gauze packs while I explore the gut,* the group leader says. There are no injuries to the gut. They close the abdominal cut with stay sutures of broad gauze band. Forty-five minutes have passed since the injury. The pig has got 3 L of Ringer, is breathing well, with HR stable at 100/minute. The students deserve the warm applause.

What is your assessment? Did they make any mistakes?

Pig with limb and chest injury

A 25-kg well-anesthetized pig gets a variety of injuries: One rifle shot through both thighs at 30 meters' range. One pistol shot through the right chest cavity well off the mid line. Multiple superficial stab wounds with a pointed knife on the front of the chest and the neck to simulate mine fragment injuries. Two more shots are fired in the ground to confuse the student group. Heng's group is called: *Help, help, there is a mine accident!* When the group comes rushing, the teacher explains: *A fragmentation mine injured this farmer ten minutes ago. The nearest village clinic* (pointing at the operating hut) *is 30 minutes away. You must do the life support here in the field, and remain here for 30 minutes before leaving.*

Find and solve the main problem

After a brief examination, Heng says: *The main problem is blood loss, the HR is at 130/minute. Han and Bun Set, stop the limb bleeding! Rattana, place an IV cannula in an ear vein, start 1000 mL Ringer, and fix the cannula with sutures. Next problem – hemothorax. To be on the safe side, I will place a chest tube before we take the victim to the village clinic.*

Assess the effect of the life support

200 mL blood is drained out by suction through the chest tube. After 2 L of Ringer the HR has dropped to 100. Heng says: *The treatment is working. But the breathing rate is still too rapid, probably due to pain. Han, give him 25 mg ketamine IV again. Then we will look for other injuries.* The group finds no other injuries, apart from the superficial stab wounds, and takes the victim to "the clinic". After a brief discussion with the group, Heng reports: *It is 40 minutes since the injury. Airways are open, RR 25, and HR 90. Chest tube and IV cannulas are fixed with sutures. The victim is stable, warm and ready for further transport. Two medics will follow the victim in the car. We transport him in the half-sitting position, legs elevated. We'll use suction on the chest tube every 10 minutes and IV ketamine 25 mg when he shows signs of pain.*

How would you assess this case?

Goat with upper airway injury

After a starting dose of 500 mg ketamine IM, a 25-kg goat is injured: Amputations of the fore limbs. One deep stab wound at the back of the right chest cavity. One pistol shot through the mouth exactly on the mid line making a briskly bleeding wound of the tongue. The student group is called and told: *This is a 10- year-old boy who stepped on a Valmara mine 5 minutes ago. It is a cold winter with snow. The nearest village clinic is 10 minutes from here, the hospital is 6 hours off. Please start!*

Find and solve the main problem

They can hear the goat snoring as the airway is partly blocked by blood. The group leader immediately decides to intubate the victim. Two other students are working to stop the bleeding from the thigh wounds. *I cannot see the vocal chords, it is all blood here even with suction,* the group leader shouts. *Give me a scalpel! Have airway tube no 6 ready. I'll do airway cut-down.* The airway cut-down is done 6 minutes after the injury, the tube is in place and fixed, and the airway well cleared with suction. At this time the goat is breathing well, RR around 20/minute.

Assess the effect of the life support. Find all injuries

When the limb bleeding is stopped 15 minutes after the injury, the HR is 100/minute. The breathing rate seems to be increasing. The students examine the chest and the abdomen, but only from the front – and miss the stab wound in the back. *The victim is in good shape, no other injuries,* the group leader says. They take the victim to the operating room. Once again they examine the victim, once again they miss the stab wound and forget to check the breathing rate. *The victim is ready for evacuation to the hospital,* they say. *No, definitely not,* says the teacher.

They forgot to look at the back. And what else?

Drinks from local foodstuffs

Where the transport takes days: Outside Lumege Hospital in Angola.

Should the students learn how to prepare drinks and food for mine victims? It depends on where you are and how much you have of resources:

- Victims with moderate blood loss don't need IV fluids for volume treatment. Drinks made from local food are good enough, and they are cheap.
- More than 12 hours to the surgical hospital? Then all victims need food during the transport.
- More than 6 hours to the surgical hospital: All child victims and all victims who are weak from diseases and malnutrition need food along the way.
- When severely injured victims return from the surgical hospital, they need good food to avoid complications.

More on feeding: See p. 66.

Drinks as volume treatment: See p. 183.

Afghan refugees.

Checklist for malnutrition

Signs of malnutrition are often overlooked. Let the students make a systematic assessment for malnutrition in a few villages in the area:

- **Anemia?** The conjunctiva inside the lower eyelid is pale.
- **Vitamin deficiency?** The skin and the mucosa of the mouth are thin and bleed. There is loss of hair, and nails easily break.
- **Wasting of muscle and fat?** During malnutrition there is loss of fat and muscle tissue. Measure the mid-upper arm circumference and compare to the normal values. You can also measure the triceps skinfold.
- **Slow growth?** Children grow slowly when they are short of food. Measure height and weight, and compare to the normal values.

Normal values: See tables p. 184.

Study local foodstuffs

All food is made up of three basic elements – carbohydrates (sugar), proteins, and fat. Fat gives the most energy. We must find cheap local sources of fat, since our task is to compose a diet rich in energy. The diet should also be balanced and contain all the three food elements. Start by finding the best sources in your area for carbohydrates, protein, and fat.

Energy content of foodstuffs: See p. 184.

This is concentrated carbohydrate. Grinding cacao beans in the jungle.

Sources of carbohydrate

The main sources of carbohydrate are grains or flour of rice, wheat, and maize. Flour stores well, and is available in most areas. Use banana, potatoes, cassava, and plantain where flour is not available. Honey and sweet fruit juice are delicious and rich in carbohydrates.

Sources of protein

Beans and peas can be dried and stored as flour. They also contain fat and increase the energy content of the diet. Fish and meat can be stored salted and dried, and ground to flour. Clear soup boiled with fish or meat is a good fluid base for the feeding solution. Milk contains protein. Milk from camel, buffalo, and sheep is also rich in fat (energy). Sour (fermented) milk and yogurt are better digested and carry less risk of contamination.

Sources of fat

Vegetable oils, butter, and ghee (butter oil) can be bought locally in

most areas. Flour from groundnuts, nuts, soy beans, and sesame seeds also contains a lot of fat (and proteins).

Malting of grains

Flour swells when it is boiled with water and makes the feeding solution sticky. Malting (fermentation) solves this problem: The grain is soaked in water for 2 days and dried before grinding. Malting is an old technique for food processing known in most countries. Malting breaks down the starch of the grain so that feeding solutions can take a lot of malted flour without becoming sticky. Malted flour should be cooked well to prevent contamination.

The "Burma Diet"

The Burma Diet was made at our Village University in Burma. In this area it takes days for the wounded to reach the surgical hospitals. The Burma Diet was used as drinks and for tube feeding along the way. The diet is based on cooking traditions from the Karen jungle villages:

Foodstuff	weight	carbo-hydrate	protein	energy
Rice flour (malted)	100 g	80 g	10 g	350 Kcal
Bean flour	100 g	–	35 g	400 Kcal
Dried fish (pound)	20 g	–	10 g	50 Kcal
Dried banana (pound)	20 g	5 g	–	25 Kcal
Ghee	25 g	–	–	225 Kcal
Wild honey	20 g	15 g	–	60 Kcal
Orange juice	50 g	10 g	–	40 Kcal
Water	1 liter	–	–	
Total		**110 g**	**55 g**	**1,150 Kcal**

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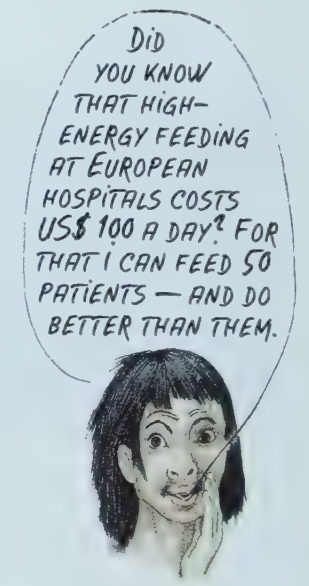

The flour is boiled with the fish, banana, and ghee in 1 liter of water. Add 1/2 teaspoon salt, honey, and fruit juice after boiling. The solution is filtered through a screen. Three liters of this feeding solution gives 3,450 Kcal. That covers the daily needs of a severely injured adult. For one victim it costs US$0.20 a day.

Make your own "Burma Diet"

Use local foodstuffs that are cheap and easy to store in roadside villages along the way to the hospital. In the Burma Diet the basic ingredients are rice flour, bean flour, and ghee. You can also use 100 g maize flour and 200 g bean flour as the base for a well-balanced feeding solution of 1,100 Kcal per liter. Or 200 g wheat flour and 300 mL milk which give you a balanced solution of 1,100 Kcal per liter.

Add vitamins and trace minerals

Bananas contain potassium and vitamin C. Deep yellow and dark green fruits contain vitamin A. Dark green vegetables contain iron and vitamin A. Dried fish contains calcium and other minerals essential for wound healing. Beans and peas contain iron, folic acid, and vitamin B.

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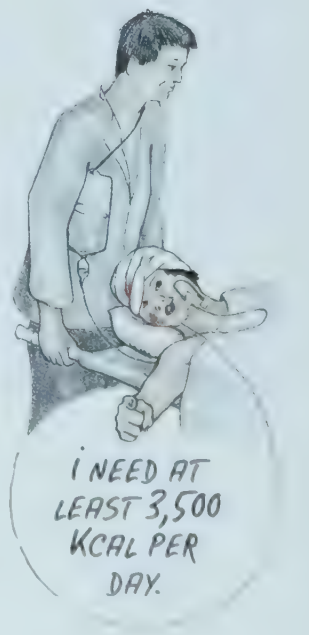


Consult the villagers

The villagers – especially the old women – know what key foodstuffs are available locally. And they know how to process, store, and prepare them. Let villagers sit in when you discuss nutrition.

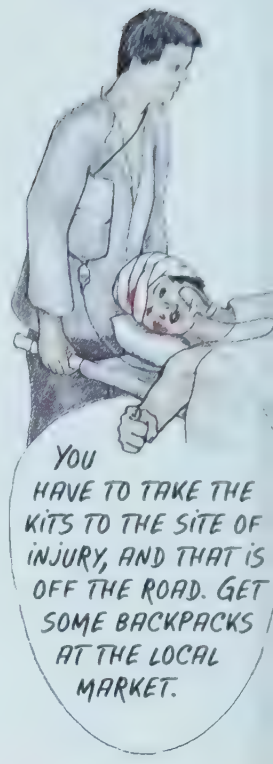
Medical kits

Cambodian first helpers with their "kits". Very simple, yet enough to stop the bleeding.

A carpenter cannot do much without a knife, saw, and hammer. A mine medic cannot do the job without tools for the airways, breathing, and circulation. At the Village University, students learn to know these medical tools by using them: Practice in life support, maintenance, repair, and disinfection should be drilled each day during the training courses.

One medical kit for each student

Each student gets his own medical kit when the training course starts. The kit contains instruments and equipment necessary to manage the life support measures students will learn during the training course. After course no. 3 the medical kit should be complete (see next page).



Some first helpers have ketamine too. See p. 171.

Kits for village first helpers

They should contain packs of gauze (or cotton cloth), and elastic bandages. Their kits should contain IV cannulas and bags of Ringer if you have trained village first helpers to give IV volume therapy.

Other first helpers are better trained – and have more equipment (see p. 171).

Kits for Basic Mine Medics

There is no fixed standard. You should match each kit so that it fits the level of training and certification of each medic. The kit should not contain equipment that the medic is not certified to use.

Kits for Advanced Mine Medics

Supplement the basic kits with laryngoscope, endotracheal tubes, chest tubes, and surgical instruments. If the medic is certified to do damage control laparotomy, the kit should contain a complete set of surgical instruments including towel clamps. If damage control laparotomy should not be done, a simple surgical set will do.

Make it simple and cheap

No high-tech

The kits are carried through mountains and jungles, in snow and rain. Therefore they must be lightweight. The instruments must work without failure at all times – elaborate and high-tech equipment does not.

Improvised and home-made equipment: See p. 190.

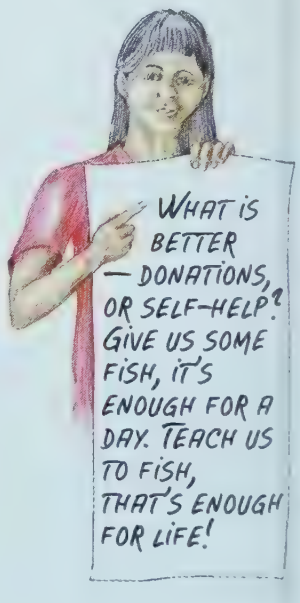
Don't import Western standards.

Maintain local control

Expensive medical programs need a lot of funding. You risk having funders from outside take control of the chain of survival.

Don't import Western standards

Local people often think that the latest Western medical standards are superior to their own. The result is abuse of broad-spectrum antibiotics, feeding solutions (ORS), and disposable instruments. Health care becomes expensive and beyond the reach of common people. This medical imperialism is hazardous to health. We must be careful that mine victim assistance does not become yet another market for the international medical companies to draw large profits.



Medical kit for simple life support

For the airways and breathing	No.	Sizes
Suction machine	1	small, operated by hand or foot
Suction catheters	6	CH 16, 14, and 10 (can be re-used)
Mucus extractors	2	suction (by mouth) for infants
Oral airway	3	small, medium, and large
Self-inflating bag	1	for assisted breathing
Face masks	3	small, medium, and large
Stethoscope	1	
Stomach tubes	3	diameter 5 mm

For the circulation	No.	Sizes
Packs of gauze or cloth	10	10 x 10 cm and 20 x 20 cm
Rolls of ribbon gauze or cloth	5	
Rolls of elastic bandages	10	minimum 12 cm wide
IV cannulas	15	0.8 mm, 1.2 mm, and 2.0 mm
IV infusion sets	4	
Lactated Ringer or NaCl 0.9%	5	1 liter plastic bags, no glass bottles
Rolls of adhesive tape	2	
Needle holder (or artery forceps)	1	to fix IV cannulas
Skin sutures	5	size 2-0 with cutting needle
Blood pressure apparatus	1	

ARNING:
UTSIDE FUNDING= OUTSIDER TAKE-OVER

Drugs	No.	Sizes
Syringes (disposable)	20	2 mL and 5 mL
Injection cannulas	20	0.8 mm x 38 mm
Injection ketamine 50 mg/mL	2	vials of 10 or 20 mL
Injection pentazocine 30 mg/mL	10	vials of 1 mL
Injection atropine 1 mg/mL	5	vials of 1 mL
Injection diazepam 5 mg/mL	5	vials of 2 mL
Injection adrenaline 1 mg/mL	5	vials of 1 mL
Injection penicillin	20	vials of 1 mega IU
Injection ampicillin	3	vials of 2 mg
Infusion metronidazole 5 mg/mL	1	bags of 300 mL

Others

Blanket/clothes to keep the victim warm and dry.
Injury Charts and pencil.
Headlight, spare batteries, rope, scissors, and knife.

Supplements for advanced life support

	No.	Sizes
Laryngoscope	1	blade for child and adult
Endotracheal tube without cuff	3	diameters 3 mm, 4 mm, and 5 mm
Endotracheal tube with cuff	3	diameters 6 mm, 7 mm, and 8 mm
Flexible stylet for the tubes	2	2.6 mm and 3.6 mm
Magill's forceps for the tubes	2	one for child, one for adult
Chest tubes (home-made)	4	diameters 6 mm and 10 mm
Artery forceps (curved)	6	14 cm and 18 cm
Scalpel	1	with 20 blades size no. 20
Surgical scissors (curved)	1	18 cm
Tissue forceps	2	18 cm, with teeth and without
Towel clamps	12	12 cm
Sutures (non-resorbable)	10	size 1-0 and 2-0 on cutting needle

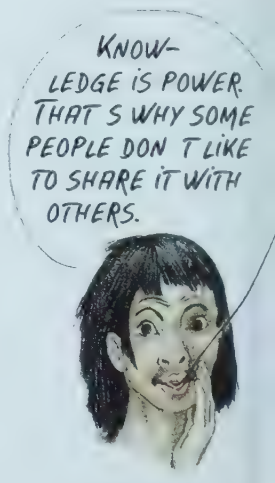
The medic as teacher

Village first helpers learning IV cannulation.

You can start an explosion of knowledge and skills if the students are also trained to become local teachers in first aid:

- **Medics can train village first helpers:** One medic trains 50 first helpers in his area. Then he selects five persons from among the 50, and teaches them to become instructors for other first helpers. If the five new teachers also train 50 new first helpers each, a total of 300 first helpers can be trained in one year. Yet it all started with one mine medic.
- **Medics can train other new medics:** Select the five most skillful from among the 20 mine medics trained at the Village University. Then train those five to become teachers for new mine medics. The five new teachers can set up two new Village Universities. In two years the number of mine medics may grow from 20 to 60.

See more on p. 168-171.

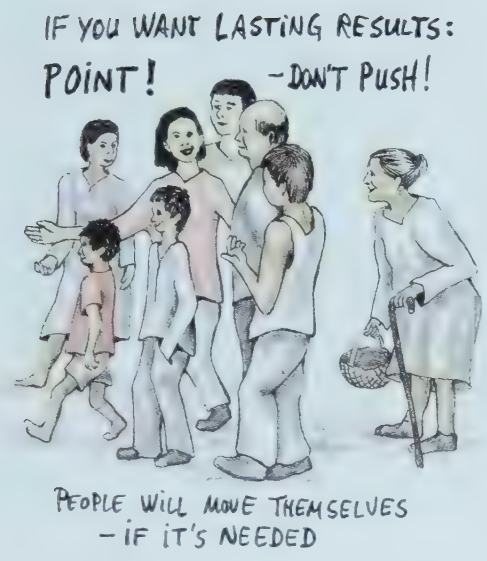


Good teaching is a matter of self-confidence

City-based medical "experts" have often criticized us: *Are you crazy? It is irresponsible to let non-graduate locals teach emergency medicine. Such education in health matters is for us experts.* We can prove this statement to be false:

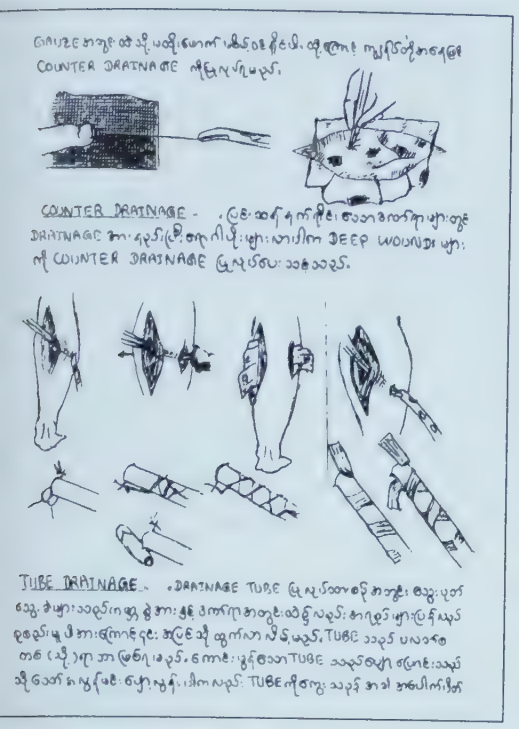
- In two years, 15 medics in the jungles of Burma – farmers and soldiers – trained a network of 1,100 village first helpers. Many of these first helpers saved the lives of mine and war victims who would otherwise have died in the jungle. No "experts" were there.
- A chain of survival ran by 20 well-trained medics in Afghanistan – farmers and soldiers – managed 3,800 mine and war victims in three years. The life support they gave in the field reduced the casualty death rate from 26% to 13%. That is a few hundred lives saved. Shouldn't those medics be competent teachers?
- Real knowledge comes from practice. So how competent are health professionals themselves who have never laid their hands on a severely injured mine victim? You should not be afraid to ask these "experts" how much real-life practice they have had (see drawing p. 138).
- Teaching is communication. But how can an outsider who gained his knowledge from reading medical textbooks make villagers understand how the body responds to a mine accident?

More about our results: See p. 12.



Good teaching is a matter of attitude

The teacher is a role model for his students. They try to learn his skills, and they copy the way he teaches. By the way he teaches his students, he sends messages on how he regards them. If he is bossy and talks "down" to them, he shows that he does not respect them. Another way of telling the students *"I don't care about your problems"* is when a teacher uses abstract terms with difficult foreign words and gives foggy answers to honest questions. Such a teacher cannot teach the students much, and when his students become teachers in the future, they will probably behave like him. The best teacher is probably one about whom the students say: *He is one of us.*



ilk-screen copy from the first Burmese manual in mine injury management. Author and artist: Mine medic Htun Htun Oh.

arge-scale picture for village aining in Cambodia. Painting n cotton.

ach yourself out of the job. ds teaching airway cut-down his last visit to Burma.

Good teaching is learnt through practice

Let two of the students run a course for first helpers in a nearby village. When the training is done, let the villagers together with the other students evaluate the training: Did the message get across? Do the village trainees feel confident about helping victims now?

Teams of teachers?

One way to get a good start for new teachers is to let them work in pairs. One of them may be a medic with good medical knowledge, but he may be shy. The other may have a good manner with people, but less medical experience. Together they make a strong teaching team.

Make local teaching aids

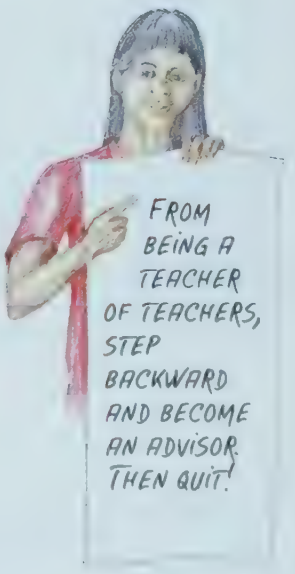
Drawings of CPR on pink Westerners with coronary heart disease do not work well in village training courses in Africa. Nor do diagnostic charts based on 12-channel laboratory analyzers. Nor is this book, written by doctors from the North for health workers in the South, the best teaching manual in your country. There are terms and descriptions in this book that cannot simply be translated into the local language because there are no similar local words. The structure of languages is so different. You make the best teaching aids yourself:

- Ask local artists to make large-scale illustrations of the main life support measures. Print a guide for teachers on the back of each drawing.
- Use silk-screen techniques to make flyers and posters that are easily copied in large numbers.
- Have pocket-size folders for village first helpers printed in the local languages.
- Draw cartoons based on local traditions and stories that can illustrate life-saving procedures without using words at all.
- Make refined copies of your notes from the Village University sessions into a useful manual for future medic students.
- Set up guides for high-energy nutrition based on local cooking traditions.

More on teaching aids: See p. 201-203.

Teach yourself out of the job

We have great responsibility as life savers since mistakes can cause complications and death. Thus all teachers training new teachers have a responsibility to follow up the new teachers carefully. It does not mean they should hang over their students' shoulders signaling: *I don't trust you.* A "supervisor" in the strict sense of the term means "one who looks down from a high position". New teachers don't need that kind of supervision. What they need is a back-up person: A person with more experience who can observe the teaching and come up with positive suggestions. One who is a friendly guide and not a boss.



Deadline: 3 years

When you start a training program, make clear your goal to the students: that they should be able to work completely independent of you. Set a deadline for them, say 3 years: *After that time you all should be self-sufficient.*

Village course for first helpers

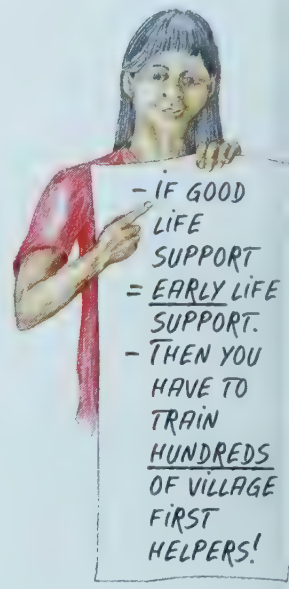
Half-sitting position, bleeding stopped – that is real life support. Kurdish first helpers 1999.

A village first helper is a villager without any kind of formal medical training. His job is to get to the mine victim as soon as possible after the injury – and help the victim survive until the medic arrives. The first helper's instruments are his two hands and elastic bandages: He knows how to keep the airways open, to support the breathing, to stop the bleeding, to keep the victim warm.

See Osman's story on p. 128.

Each medic should train 50 village first helpers

The most important life support is immediate life support. Train so many first helpers that there will probably be a first helper nearby whenever a mine accident happens. **Where?** Select the areas that have the most mine accidents. **Who?** Let 1/3 be schoolchildren, 1/3 women, and 1/3 men. Even if women are less often injured by mines, their skills often make them the best assistants for the local mine medic.



Two-day courses in the villages

- Why two days? Because you need the night. The quiet informal talks at night over cups of tea are sources of information, and make the trainees understand that they are part of a team.
- Who is the instructor? It is the mine medic from the nearest village. He organizes the course and selects the trainees with the help of the village leaders.
- How many should attend each course? Set a limit at 20-25 persons.
- Equipment and costs: The hands-on training can be done on dummies, or on fellow villagers. Bring large flip-over illustrations and hand-outs, or prepare a blackboard where you can draw the anatomy. Bring five rolls of elastic bandage for each trainee. Try to cover the trainees' travel costs and provide food for them.

Teaching aids: See p. 201.

The first day of the course

Start with a role-play. Let one trainee act as a mine victim with a bleeding limb injury. The instructor plays the part of the village first helper: He examines the airways, then assesses the breathing. He calls some trainees to assist him and stops the bleeding by lifting the leg, pressing on the artery. He shows how to pack gauze into the "wound", and how to apply a compressive dressing. The "mine victim" vomits and the instructor demonstrates the recovery position with a head tilt-chin lift. It's the rainy season, so the "victim" becomes wet and cold. The instructor covers him with blankets and calls for bottles of warm water. Conclusion: *These simple measures save lives.*

But how to get him out of the minefield? See p. 152.

Lesson one: Oxygen starvation

The candle flame dies without oxygen. Describe the airways and point out one reason for death – blocked airways. Let all practice the recovery position.

Show how the lungs work like a suction pump, taking oxygen into the blood, and point out another reason for death – poor breathing. Practice the half-sitting position.

Compare the blood circulation to a watering system: a leak at one point causes slow flow and dry fields. Point out another main reason

for death – blood loss. Practice artery compression on the arm and at the groin.

Lesson two: Airways and breathing – practice

- First, the patient is breathing but the airways are blocked: How to examine the airways. Head tilt-chin lift. Recovery position, carry patients over the shoulder, and face down on the stretcher. Carry patients half-sitting.
- Second, the patient does not breathe: Mouth-to-mouth rescue breathing on dummies or simulate the method on each other.

Take a lot of tea-breaks. Humor and high spirits help the learning.

Lesson three: Stop the bleeding – practice

- Lift the bleeding limb, press on the brachial artery or the femoral artery, imitate packing of deep fragment wounds or amputation wounds with cloth.
- Criss-cross compressive dressings from the toes to the groin and from the fingers to the armpit by using elastic bandages.
- Practice measures to keep the patient warm. Let the villagers come up with their own ideas.

Dinner and informal discussions

Discuss previous accidents in the area: *If you knew then what you know now – could you have saved lives in those cases? Would you feel more confident assisting at an accident now?* Work out ways of calling out the first helpers and the mine medic in case of accidents.

You can use the case stories in Section 4.

The second day of the course

Rehearsal: Ban the tourniquet!

Explain why the tourniquet does not work, and why it is a limb killer. Give case stories from the area. Show photos from this book (p. 32, 33 and 50). Repeat yesterday's lesson on how to stop the bleeding.

Lesson four: CPR

Let the students check one another's carotid pulse beat, and the brachial artery pulse beat in some village infants. When a victim is not breathing – start CPR at once. Practice CPR on adults and infants with one first helper, and with two first helpers together.

Conclusion

- Make a local action plan: Use recent local accidents as examples. Agree on a system to alert the first helpers and the mine medic. If the victim is lying inside a minefield, who should get him out? And how? Should stretchers be prepared? And a car?
- Certification and elastic bandages: Certify the trainees as first helpers. A certificate with the signature of the instructor can be useful if they have to take a victim through checkpoints. Give five rolls of elastic bandages to each.

More on certification: See p. 174.

Refresher training course after 4 months

Why? To correct any mistakes and to build up their skills.
How? Discuss accidents where the first helpers took part. Repeat the practice from the first training. Look at the local action plan again and see how it can be further improved.

Build an army of first helpers

Sok Lip and the other trainers on motorcycle with students and silk-screen posters.

Can I really do this? Sok Lip shouted as they rode on their small motorbikes to the village Kilo 38 in the west of Battambang Province. *Can I teach villagers CPR and how to stop the bleeding from a mine injury? Will they understand what I'm telling them?* Sok Lip was travelling together with Vouthy and Bun Seut, the two other mine medics from Sdau district hospital. They carried the roll of 13 new posters with nice color illustrations and text in Khmer, their own language. Lip also had a backpack with 50 rolls of elastic bandage. *Sure you can do it.* Bun Seut shouted to him. *Remember you're one of them – they know you and respect you. They are starving for this practical knowledge.*

Twelve 9th grade students were awaiting them in the village school. Vouthy had selected them according to their families' work, the recommendations from the village leader and discussions with their schoolteacher. All 12 students had seen mine injuries. Yoeum Pom had watched her brother being killed when she was seven. *I'll never forget it as long as I live. I felt so helpless. Now I want to learn how to help.*

Training to apply the elastic bandage in Village Kilo 35.

Twelve curious pairs of eyes looked at Sok Lip and the medics. *Good morning, my friends,* began Sok Lip. *We want to teach you some important life-saving skills. You are the ones closest to the mine victims. Someone has to start life-saving first aid at once. If not, the victim risks dying. We, the hospital medics, can do little if the victim is choked or has lost almost all blood.* Vouthy had put up the silk screen-posters on a metal stand. *First we'll discuss the basic needs of the body. Then we will show you how to open airways, how to give rescue breathing and CPR, and how to stop bleeding.* Sok Lip felt confident now. *This is going to be a good day,* he thought.

Also see Osman's story on p. 128.

Two levels of first helpers

Medics in Cambodia and Kurdistan have been running village training of first helpers for three years now (1999). They train people at two different levels:

1. Village first helpers, 1-2 days of training.
2. Advanced first helpers, 3 days of training.

Village first helpers

Groups of 10-25 children or adults learn about the body's basic needs, types of weapons and injuries, simple life support that can be done without equipment and drugs. By the end of the training, each student gets 3 rolls of elastic bandage, and some pocket money. Total training cost per student: US$3.40. See schedule on p. 168-169.

Advanced village first helpers

A few of the most skillful first helpers are asked to take on extra responsibility as advanced first helpers. The kind of life support measures depends on the local setting: The medics in Cambodia and Kurdistan have carefully analyzed the patterns of injury, transport times, and means of transport. And they have come up with different training programs accordingly.

The Battambang model

Bun Seut teaching villagers.

Let us look at the local setting in Battambang Province, Cambodia. In the rural areas of this small province there are small district hospitals staffed with experienced mine medics like Bun Seut. In key villages inside the minefields there are well-trained mine medics like Sok Lip and Vothy, all of them with a medical kit for advanced life support, all of them on 24 hours' duty. The transport time for most mine victims from the site of injury to the nearest medic or district hospital is thus 1-2 hours. There are, however, "white spots" on the map: village areas inside the minefields where there are no mine medics or village clinics. From these areas mine victims have many hours to go before they get good life support – especially so during the rainy season when roads are muddy and victims get cold from rain and wind.

Heng and the other medics in Battambang have therefore found it more important to train a lot of advanced village first helpers in key villages than to train thousands of village first helpers. By now almost 650 village first helpers and more than fifty advanced first helpers have been trained. The program for advanced village training includes:

- Treatment of fractures: Setting fractured bone in the correct position and splinting them.
- IV cannulation of arm veins, and how to give IV volume treatment.
- Giving IV ketamine pain relief.

By the end of the three days-training, the advanced first helpers get a bag with 8 rolls of elastic bandage, 3 L of Ringer, 4 IV-cannulas, ketamine, tape, scissors, a notebook and a pen (see photo p. 164).

The Suleimaniah model

illage training course at the anian border with Hikmat, ebak, and a dummy.

Suleimaniah Governorate in Kurdistan is big: 150 kilometers separate the minefields in the mountains near Iran from the surgical hospitals in Suleimaniah city. Due to years of war and the UN embargo, few district hospitals are working and there are no clinics at village level. As most mine accidents happen in the mountains, many victims are carried off the road and on extremely poor roads for 3-4 hours without getting any life support. The transport times can be even longer in winter with snow and freezing temperatures. Dr. Mudhafar and the medics in Kurdistan have analyzed the injury pattern in mine victims from the area and found that more than 1/3 die in the mountains getting no life support at all.

Results from Cambodia and Kurdistan: See p. 13 and 196.

Dr. Mudhafar and his team have therefore trained an "army" of first helpers in the mountain villages. The aim is to get to the injured sooner to reduce the high death rate.

- So far 2,800 village first helpers have been trained.
- In addition 150 advanced first helpers are trained in key villages. The teaching aims are the same as the Battambang model's.
- As transport times are long and mass casualties common, the advanced first helpers keep supplies of dressing materials, elastic bandages, IV fluid, ketamine, and stretchers along the way.

Is the treatment good enough?

Is the chain of survival really working? The main proof of good treatment is good results. The best result is good survival, meaning as little loss of limbs or social functions as possible. The worst result is death. So, one way to find out if the life support was good enough is to compare the outcome at the hospital with the treatment you gave in the field. The students should learn to use this method at the Village University. Study case reports and charts from the file or examples from this book.

Learn from other countries. Publish reports
The mine epidemic is international. We must cooperate within countries and across borders to fight this epidemic. There are so many health workers in mine-infested areas with much experience in saving the lives of mine victims. We have to carefully record the injuries, the treatment, and the outcome in order to compare results and learn from each other.

More on quality control and statistics: See p. 192-197

Cooperate closely with the hospital

Ask the surgical hospital to record results and complications in a Hospital Injury Chart and to give you a copy for all the victims you treated. Explain to the hospital doctors that you need this information to control the quality of your own work – not to interfere with the hospital treatment. Let a few nurses or doctors from the hospital study at the Village University – that is the best guarantee for cooperation.

All personal information should be kept confidential. No access for outsiders!

This is the Hospital Chart of Rok Hang, the farmer who stepped on a PMN mine September 15, 1997.
See his Injury Chart on p. 80.

Register the Severity Score (SS) on admission: You – as the mine medic – have already registered this score for the victim. Ask the hospital staff to record it too, to be sure you get it for all the victims.

See p. 80.

Register the level of surgical amputation: Draw on the illustration the level of the surgical amputation. Comparing this with the Field Injury Chart, we can find out how much of the limb is lost.

Register complications:
- How many units of blood transfusion (indicator of blood loss)
- How many operations
- Types of infection
- Organ failure
- Death

Definitions of medical complications:
See p. 193-194.

Hospital injury chart

The patient
Name of doctor: Dr. Davoung — Name of hospital: Battamb. Prov. Hosp.
Name of patient: Rok Hang — Sex: ☒ M ☐ F
From which village: Undek Hep — Age: 35
Name of patient's father: —

Time of stay
Time and date of admission: 15/9/97 11:30a.m — Discharged (date): 30/9/97
Out-patient from (date): — — To (date):
Referred to other hospital, when: — — Which hospital:

Condition at admission

	4 points	3 points	2 points	1 points	0 points	Sum	When was this examination done:
Breaths per minute	10–24	25–35	more than 35	less than 10	no breathing	11	15/9/97 11:30am
Systolic blood pressure	more than 90	70–90	50–69	less than 50	no pulse		
Mental response	normal	confused	to sound	only to pain	no response		

Rectal temperature before treatment: 36.2 °C — time: 15/9/97 11:30 am

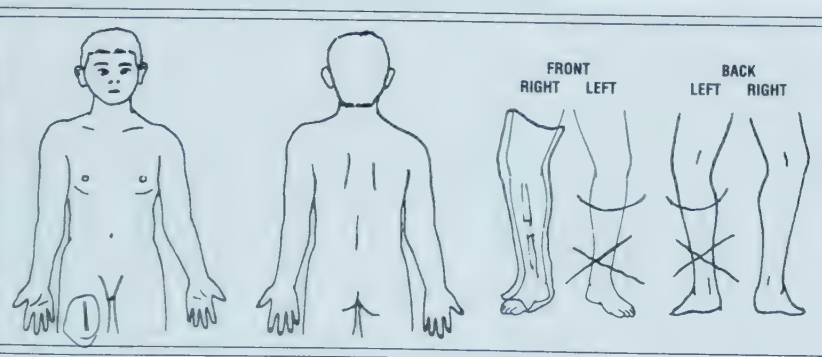
Laboratory at admission: Hb 9,2 hct 22 group: A+

Hospital diagnosis
1 Below knee amput (1/3) left
2 Below knee comp. fracture right
3 Dep wound right thigh
4
5

Treatment (type and time)
1 Below knee amput (1/3) left
2 Debridement + P.O.P. right L. leg
3 Debridement + DP Suture
4
5

Hospital complications
How many units of blood transfusion: 2 (15/9/97)
Wound infection: yes, right lower leg. Debridement x 3
Peritonitis: /
Pneumonia: /
Other

Draw level of surgical amputation



Mortality
Time of death: /
Main reason for death:
Remarks: Loss of weight

AK Grafisk

Dedicated and concerned. At a medic meeting in Cambodia.

Quality control using Field Charts

Let us say you are a teacher and have trained five mine medics. You can check the quality of the job they do by comparing two groups of victims treated at different times. Here is an example:

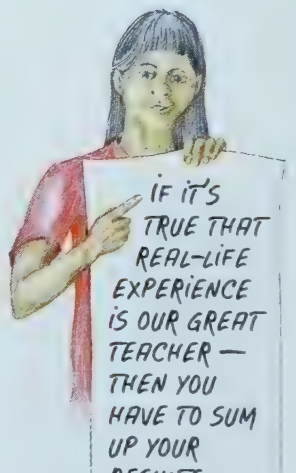
The first control: January – June, 32 mine victims (Group 1)

- First, find out how many were severely injured: From January to June the five medics managed 32 mine cases. Of the 32 victims, 18 had SS1 at 10 or less before treatment. So 18 of the 32 victims (56%) were severely injured. You should use this group of 18 (Group 1) to check the quality of treatment given.
- Then, compare SS1 with the Severity Score at hospital admission (SS2) for the severely injured cases: In 5 of the 18 severely injured, SS2 was less than SS1. Two patients had SS1=SS2.
- Conclusion: In 2+5=7 patients (39% of the severely injured victims) the life support given by the five medics did not improve the victims' condition. That's not good enough. Therefore you decide to arrange a 100-hour refresher course in July for the medics.

The next control: August – December, 20 mine victims (Group 2)

After the course in July, the five medics had 20 cases.

- First, compare the injury severity in Group 1 and Group 2: 15 of the 20 victims (75%) in Group 2 were severely injured (SS1 at 10 or less). In Group 1, 56% were severely injured. So, the injuries August-December were generally more severe.
- Then, compare SS1 with SS2 in Group 2: Only 3 of the 15 severely injured in Group 2 (20%) had SS2 **less** than SS1. This means that your medics were able to improve the condition in 80% of the victims in Group 2. Compare this to 61% (100-39=61) in Group 1. Remember that the Group 2 injuries were generally more severe. So, your team's work did improve.



Quality control using Hospital Charts

Let us look at the two groups of mine victims again. Now we compare the **quality of the field treatment** with the hospital outcome.

- 12 of the victims in Group 1(38%) had wound infections at the hospital. Only 5 victims in Group 2 (25%) had wound infections. All victims with SS2 **less** than SS1 were reported to have wound infections.
- 6 of the victims in Group 1 (19%) died at the hospital. Only 2 victims in Group 2 (10%) died. Those who died were all **victims with SS2 less than SS1.**

Conclusion

Victims who do not get better as a result of early life support are at risk of dying or getting complications at the hospital.
In other words: It is a dangerous sign if the severity score is going down during the transport to hospital.
Do all you can to improve the life support.

Study Ahmed's story again: See p. 36.

Certification

The mine medics and the village first helpers should get a formal certificate after the training – if they have the necessary skills and honesty. The certificate is a legal permit that allows them to use their skills for the benefit of mine victims.

Who should sign the certificates?

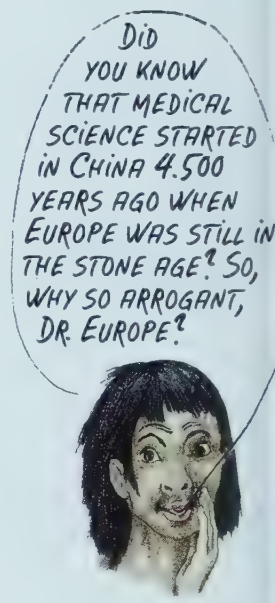
Simply by signing, the signatories get a position of power. They can choose to support the chain of survival – or break it. Should the signatories be local authorities like village leaders, health committees, or religious heads? Or should they be central health authorities? Or outsiders like medical professionals and expatriate NGOs?

A question of power

You find corrupt and unfair leaders in all countries at all levels – in the villages, the regional power centers, and in the international organizations. Corruption takes place when leaders use a position of control for their own gains, not for the gains of the poor. Corruption is never open. Unfair leaders often hide their real aims behind friendly phrases like *"community participation", "rural development", "humanitarian mine action"*. **But note:** At the same time, their nice words and promises give poor rural communities a chance to persuade these corrupt leaders to support them. Imagine how this can be done: *Dear boss, you say you encourage community participation. Here we are a task force of 20 well-trained medics and 600 village first helpers. Imagine the good results, the foreign funding, and the reputation you'll get if you use this task force to set up more Village Universities.* In so doing, you begin a political struggle. Twenty teacher-medics and 600 lay health workers form a formidable mass movement. So if you also have good back-up from professional friends, you could win the political struggle.

Friends – or false friends

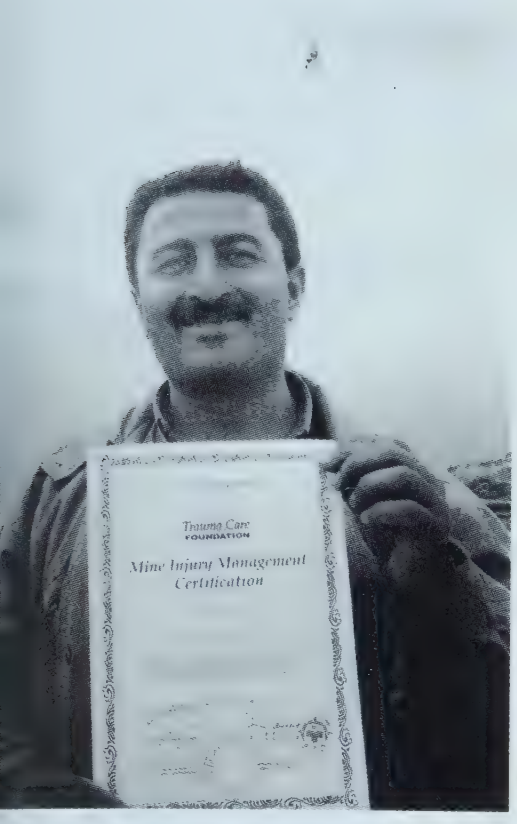
We have been told by "experts" that a Kurdish (also Khmer or Angolan) farmer is too stupid to do endotracheal intubation. If we were to believe that, we would have lost even before we started. There are so many sad examples of community-based health programs that had a flying start, and then collapsed under the burden of "experts" from outside. "Experts" that had to take charge to prevent "stupid locals" from making mistakes.



Be cautious

- Plan low-tech and low-cost programs. Less funding means less risk of foreign takeover.
- Invite equals (medics, instructors) from other areas and countries to teach at your local Village University.
- Deal firmly with outsiders: Allow visitors and "monitoring missions" to stay for just a few days – and on the condition that they fully share the local way of living.
- Let local health workers be in charge of the teaching, let professionals from outside be advisors only.
- Set up clear-cut written agreements with local authorities and funders: Short-term agreements negotiated yearly are safer than long-term contracts. State the duties of the outsiders and the rights of the insiders very clearly in the contracts.

Certificates



Who should sign the certificates?

Village first helpers

The certificate is a legal permit allowing its holder to provide basic life support to victims of injury. List the specific techniques the first helper is allowed to use. Set an expiry date (the certificate is valid only if the refresher training course is done within the last 24 months). Fill in the date and instructor's signature from the last training course. On the back of the certificate, write a request to "whom it may concern" to give help and freedom of movement to the first helper when he manages injured persons.

Refresher training: See p. 141 and 169.

Mine medics

The certificate is a legal permit which allows its holder to give life support to victims of injury. There should be separate certificates depending on how many Village University courses the medic has completed. Specify the life support measures and the drugs that the medic is allowed to use. Set an expiry date: The certificate should be renewed every year (provided that the medic passes the refresher courses and tests).

Agreement to define the job

All medics who passed the Village University courses should sign an agreement that regulates his rights and duties:

- **Matters of ethics:** Be on duty 24 hours a day. Treat all patients regardless of ethnic, political, and religious affiliation. The treatment is free, medics cannot charge patients or their families any money.
- **Medical limitation:** Treat only victims of injury, accidents and life-threatening conditions. List the type of medical assistance that the medic is allowed to give, and medical assistance he is not allowed to give.
- **Documentation:** Fill in exact Injury Charts on all patients. Personal information about patients must be kept secret.
- **Refresher training:** The certificate is only valid if the medic takes part in all recommended refresher courses.
- **Teaching obligations:** Train and look after village first helpers.
- **Medical equipment:** The medical kit is the property of the chain-of-survival program. The medic is responsible for resupplying the kit and for maintaining the equipment according to rules set. Equipment lost or damaged by careless handling should be replaced at the medic's own cost. Use of equipment for private practice is forbidden.
- **Back-up:** The medic has the right to get back-up and assistance both in medical treatment and in teaching.
- **Legal matters:** The medic is free to break the agreement without prior warning. In case of misconduct, the medic can be dismissed from his position without prior warning. In either case, all files and equipment must be returned to the local organization.

Now you are through

This is the last chapter in the book. Let us hear from you in order to make future editions better. See inside frontcover.

Some practical advise

Drugs and doses

If the transport to hospital takes less than 8 hours, we give a single dose of antibiotics. These doses ar listed in the table as "Prevent". If the transport takes more than 8 hours, we give repeated doses to th severely injured. These doses are listed as "Treat".

Drug	Action of the drug	IV drug dose for adult
Antibiotics		
Penicillin G	Standard drug for infections of limbs, airways, and skull. In high doses effective against anaerobic bacteria.	Prevent: IV 8-12 million IU one time. Treat: IV1-5 million IU every 6 hours.
Ampicillin	Standard drug for infections of abdomen (together with metronidazole or chloramphenicol) and airways.	Prevent: IV 2 g one time. Treat: IV 0.5-2 g every 6 hours.
Metronidazole	For anaerobic infections such as tetanus, gas gangrene, peritonitis, and deep wound infection. Standard drug against amebic dysentery.	Prevent: IV 1,500 mg one time (infusion for 30 minutes). Treat: IV 500 mg every 8 hours (infusion for 20 minutes).
Chloramphenicol	In combination with penicillin G for several types of severe infections, including some anaerobic infections.	Prevent: IV 1.5 g one time. Treat: IV 500 mg every 6 hours.
Oxytetracycline	For several types of infections, but no effect on anaerobic infections unless combined with metronidazole or chloramphenicol.	Prevent: IV 1 g one time. Treat: IV 0.5-1 g every 12 hours.
Doxycycline	Same action as oxytetracycline.	Prevent: IV 200 mg one time. Treat: IV 100 mg every 12 hours.
Cloxacillin Dicloxacillin	To treat severe limb infections if penicillin does not work.	Treat: IV 1-2 g every 6 hours.
Gentamycin	To treat severe infections in combination with penicillin G or cloxacillin.	Treat: IV 120-240 mg every 8 hours (see: side-effects).
Drugs for pain relief		
Ketamine for pain relief	For severe pain, especially in victims with blood loss.	IV 0.2-0.3 mg/kg in repeated doses (every 30 minutes-1 hour). IM 2-3 mg/kg.
Ketamine for anesthesia	For surgical anesthesia in victims of injury.	IV 1-2 mg/kg. IM 10-20 mg/kg.
Pentazocine	For moderate to severe pain.	IV 30-60 mg every 2-4 hours.
Morphine	For severe pain.	IV 5-10 mg every 2-4 hours.

IV drug dose for children (per kg body weight)	Side-effects	Cost of vials for injection
Prevent: IV 200,000 IU/kg one time. Treat: IV 25,000/kg every 6 hours.	Allergic reactions (seldom).	moderate
Prevent: IV 100 mg/kg one time. Treat: IV 25 mg/kg every 6 hours.	Allergic reactions (seldom). Prevent diarrhea by drinking sour milk or yogurt, do so also if other antibiotics below are used.	cheap
Prevent: IV 20 mg/kg one time. Treat: IV 7.5 mg/kg every 8 hours.	Vomiting and diarrhea (common). Headache and convulsions (seldom).	very expensive
Prevent: IV 25 mg/kg one time. Treat: IV 10 mg/kg every 6 hours.	Vomiting and diarrhea (common). Damage to the production of blood cells in the bone marrow: Stop treatment immediately if hemoglobin or platelet counts fall.	moderate
Prevent: IV 15 mg/kg one time. Treat: 10-15 mg/kg every 12 hours.	Vomit and diarrhea (common). Do not use in children less than 12 years (damage to teeth).	very expensive
Prevent: IV 3 mg/kg one time. Treat: 1.5 mg/kg every 12 hours.	Side-effects as for oxytetracycline.	Very expensive
Treat: 25 mg/kg every 6 hours.	Diarrhea (common). Allergy (seldom). Pain and swelling at the site of IV injection.	cheap
Treat: IV 2 mg/kg every 8 hours.	Damage to the brain if dose is higher than recommended. Give every 12 hours only to persons older than 60 years.	moderate
Dose: as for adults.	Positive side-effect: Increases BP. Negative side-effects: Hallucinations and unrest (reduced with diazepam).	expensive
Dose: as for adults.	Poor breathing or temporary stop of breathing if given fast IV.	expensive
0.3-0.5 mg/kg every 4 hours.	Allergy (common). Vomiting and poor breathing (but less than morphine).	moderate
0.1 mg/kg every 4 hours.	Vomiting (common). Low BP and poor breathing after high doses. Problems of voiding.	cheap

Drug	Action of the drug	IV drug dose for adult
More drugs for pain relief		
Buprenorphine	Synthetic morphine-like drug for severe pain.	IV 0.3-0.6 mg every 6 hours.
Paracetamol	For moderate pain, especially in the limb injured.	P.o. tablets 0.5-1 g every 4-6 hours.
Alcohol (ethanol)	For moderate and severe pain where no other analgesic is available.	P.o. 25-50 mL 45% ethanol (brandy, whiskey, etc.) every 1-2 hours.
Drugs for malaria		
Quinine	Drug of choice to treat malaria crisis and severe falciparum malaria.	Treat: 1,000 mg quinine in 500 mL glucose 5% as infusion for 2 hours. Then IV 10 mg/kg every 8 hours.
Mefloquine	In combination with oxytetracycline or doxycycline (above) to treat (not prevent!) malaria that did not respond to chloroquine.	Treat: Tablets 750 mg initially, 500 mg after 6 hours, and 250 mg after 6 more hours.
Pyrimethamine-sulphadoxine	As for mefloquine.	Treat: Tablets 1.5 g sulphadoxine with 75 mg pyrimethamine one time.
Local anesthetics		
Xylocaine, Lidocaine	Local anesthesia as infiltration, nerve block, IV regional anesthesia, or pleural anesthesia by chest tube.	Maximum doses: • Lidocaine: 5 mg/kg. • Lidocaine with adrenaline: 8 mg/kg.
Bupivacaine	As for lidocaine but slower onset and longer duration.	Maximum doses: • Bupivacaine: 2 mg/kg. • Bupivacaine with adrenaline: 3 mg/kg
Other drugs		
Adrenaline 1 mg/mL	To treat severe allergic reactions. For advanced CPR (heart arrest).	Allergy: IV 0.1-0.2 mg (dilute 1 mg in 9 mL Ringer, give 1-2 mL of this solution Heart arrest: IV 0.5-1 mg.
Atropine	To reduce salivation and risk of vomiting during ketamine anesthesia and analgesia. To treat toxic reactions to local anesthetics (see above).	IV 0.5 mg every 2 hours during ketamine anesthesia.
Diazepam	To reduce mental side-effects of ketamine. Reduce anxiety. To treat convulsions (brain injury, malaria crisis, toxic reactions to local anesthetics).	IV 2.5-5 mg in repeated doses. Convulsions: IV 10-20 mg.
Metoclopramide	To reduce vomiting during transport, especially during morphine analgesia.	IV 10 mg every 2-4 hours.

IV drug dose for children (per kg body weight)	Side-effects	Cost of vials for injection
Should not be used in children.	Vomiting and poor breathing, but less than morphine.	expensive
10 mg/kg every 6 hours.	Allergy (seldom).	cheap
Should not be used in children.	Drowsiness and vomiting (common).	cheap
Treat: 10 mg/kg quinine in glucose 5% as infusion for 2 hours. Repeat every 8 hours.	Dizziness, vomiting, headache (common). Diarrhea is common after high doses. Allergy (seldom).	cheap
Treat: Tablets 20 mg/kg one time.	Dizziness, vomiting, diarrhea (common). Hallucinations and nervous disorders (seldom).	expensive
Treat: Reduce the dose according to body weight.	Allergy to sulphadoxine (common).	moderate
Maximum doses: as for adults.	Allergy (seldom). Toxic reactions (normally due to overdose): • Drowsiness, convulsions: Open airways. IV diazepam 0.1 mg/kg. • Low BP: Limbs up! IV Ringer rapidly. • Low HR: IV atropine 0.5 mg.	moderate
Maximum doses: as for adults.	Allergy (seldom). Toxic reactions: as for lidocaine.	expensive
Allergy: IM 0.1 mg/10 kg. Heart arrest: IV 0.1 mg/10 kg.	Unrest, dizziness, high HR, increased BP (common). Irregular heartbeats (after high doses).	cheap
IV 0.1 mg/10 kg every 2 hours during ketamine anesthesia and analgesia.	Dry mouth, blurred vision (common). Irregular heartbeats (high doses). Allergy (seldom).	cheap
IV 0.2-0.5 mg/kg. Convulsions: IV 0.5-1 mg/kg.	Drowsiness, confusion (common). Warning: Diazepam may accumulate and cause severe side-effects after repeated doses: low RR and BP in patients with oxygen starvation and blood loss, circulatory collapse in severely injured children.	moderate
IV 1.5 mg/10 kg.	Unrest and convulsions, mainly in children (seldom). Allergy (seldom).	expensive

IV fluids for volume treatment

Use electrolyte solutions

You can choose between Lactated Ringer (also called Hartmann's solution or simpl "Ringer"), and 0.9% Sodium Chloride (0.9% NaCl, also called normal saline or NS) In both the mixture of salts (electrolytes) is similar to that in human blood. One is no better than the other, so use what is available at the best price.

Electrolyte contents (mmol/l) in fluids for IV volume therapy

	Na+	Cl-	K+	Ca2+	HCO3-
Lactated Ringer	131	111	5	2	29
0.9% NaCl	150	150	0	0	0
Normal blood	132-144	95-107	3.3-4.7	2.12-2.62	24-30

Do not use colloid solutions

Colloids are IV fluids that imitate the composition of human blood plasma. There are tw main types of IV colloid solutions:

- Natural colloid: Albumin 40 mg/mL or 200 mg/mL
- Artificial colloid: Fluids containing dextran (Macrodex, Plasmodex, Promiten, etc.), an fluids containing gelatin or polygelin (Hemaccel, Plasmacel, etc.)

Colloids have been used in combination with electrolytes for IV volume treatment especially if a lot of blood is lost. However, recent studies indicate that there is no bene fit from using colloids rather than electrolytes in volume therapy. In fact, it seems that IV colloids may cause complications and increase the risk of dying from severe injuries. Besides, the prices of colloids are 5 to 10 times that of IV electrolytes.

Do not use dextrose or glucose

IV solutions of dextrose or glucose cannot be used to replace blood loss. The solution contain so little carbohydrate that they are of no value for feeding. The rest of these solutions is plain water. Water does not help build up the blood volume. It leaves the bloodstream and only causes tissues to swell.

Blood transfusion

Transfusion is the best way to replace blood loss in patients who have bled a lot. The technique of auto-transfusion (collecting the blood lost by the patient and re-infusing it) is especially useful in settings with minimum resources. However, blood transfusion is for hospitals only.

Drinks for volume treatment

You should **not** use drinks to replace blood loss
if the victim has bled a lot,
or the victim is very weak or unconscious,
or there is injury to the abdomen.

The drink should contain carbohydrate

The drink should be absorbed as fast as possible from the intestines into the bloodstream. The absorption of salt (sodium) from the intestines is 3 to 10 times faster if the drink also contains carbohydrates. You may simply mix table salt and sugar in water. But too much sugar may create an osmotic pull that draws water back from the bloodstream into the intestines – and the absorption slows down. Therefore it is safer to use other carbohydrate sources such as rice, maize, wheat, millet, or whatever staple there is in the village. Make soups or dilute traditional porridges with water to make a thin drink that is easy to swallow.

Too much salt is dangerous

Half a teaspoon of salt per liter is enough. With more salt, the absorption from the intestines becomes slow.

Don't waste time by boiling water

Time is critical for the injured, and boiling takes time. If the victim gets some gastroenteritis from unclean water, that is a small problem compared to oxygen starvation due to blood loss. Besides, you can reduce the risk of stomach problems if you make the drink from yogurt or soured porridges (porridges made from fermented grain). The acidity that comes with the fermentation by lactic acid-producing bacteria delays growth of harmful bacteria, even if you use unclean water for dilution.

How much should he drink?

The victim needs to drink 3-4 liters to replace one liter of blood lost. If the hospital is far away, the total amount taken should also cover the body's daily need of fluid: for an adult that is 3 liters a day. Use this guideline: Let the victim drink until he can pass urine – but not so much that he starts vomiting.

Why not ORS packets?

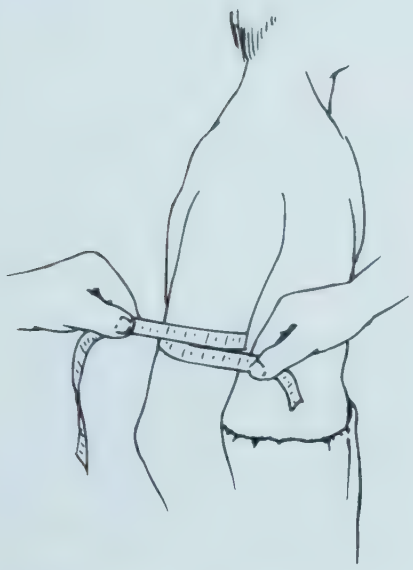
ORS means oral rehydration solution, a drink to replace blood volume lost. ORS packets contain a mixture of salts and simple sugar. The contents of one packet is to be mixed with one liter of water to make an oral rehydration solution. The problem with ORS packets is that they contain too much salt, cost money, and that they are not readily available. Also the absorption is slower compared to drinks made with other carbohydrates.

Advantages of home-made drinks

- Rapid absorption
- Nutritious at the same time
- Treatment can start immediately
- Low cost, more self-sufficiency in the use of local resources.
- Reliance on people, local knowledge, and education
- Control and responsibility in the hands of the villagers.

Malnutrition and feeding

Use these tables to check for malnutrition: See p. 162.



Mid-upper arm circumference (MUAC)
MUAC is a measure of how much muscle we have in our body. A person with MUAC 20% below normal is probably undernourished. A person with MUAC 40% below normal is severely undernourished.

Reference weight (kg) for height (cm), both sexes combined

height	*normal weight*	*undernourished (80% of reference)*	*severely under-nourished (60% of reference)*
50	3.4	2.7	2.0
60	5.6	4.5	3.4
70	8.5	6.8	5.1
80	10.8	8.6	6.5
90	13.1	10.5	7.9
100	15.6	12.4	9.3
110	18.4	14.8	11.1
120	22.0	17.6	13.2
130	27	21.5	16
140	34	27	20.5
150	41	33	24.5
160, female	50	40	30
160, male	48	38.5	29

Normal values of MUAC and TSF

Age (years)	*MUAC female (cm)*	*MUAC male (cm)*	*TSF female (mm)*	*TSF male (mm)*
1-2	15	15	10	10
3-4	16.5	16.5	11	10
5-6	17.5	17.5	10	9
7-8	18.5	18.5	11	8
9-10	20.5	20.5	13	10
11-12	22.5	22.5	13	11
13-14	25	25	15	10
15-16	25	27	17	8
17-18	25	29	18	9
19 upwards	28	31	> 21	11

Triceps skinfold (TSF)
The thickness of this skinfold gives an estimate of how much fat we have in our body. Values 40% below normal indicate undernourishment.

Use the tables to set up local diets: See p. 163.

Content of nutrients in key foodstuffs (per 100 g)

	carbohydrate (gram)	*protein (gram)*	*energy (kcal)*
Energy sources			
Lentils, beans, chickpeas		30	400
Flour (wheat, maize, rice)	80	10	300
Groundnuts		25	600
Coconuts	80		400
Coconut milk	60	5	250
Seeds of melon, sesame, cotton		20	600
Full-cream milk powder	40	25	500
Butter, ghee, vegetable oils			800
Protein sources			
Meat		20	200
Dried meat		50	500
Fish		20	100
Dried fish		50	300
Eggs		20	150
Milk		5	100
Cheese (low fat)		20	100
Cheese (fat)		20	400
Carbohydrate sources			
Sugar and honey	100		400
Banana	25		100
Fruit juice	25		100

Field standards of volume and weight

Home-made feeding solutions should be carefully prepared. You can make a balance scale yourself: one liter of water or milk weighs 1 kg.

Without scales you can calculate the weights this way:

- First measure the volumes of the foodstuffs: One teaspoon is 2.5 mL. One tablespoon is 8-10 mL. One teacup is 100-50 mL.
- Then, multiply the volume with the volume-weight factor (see the table): Volume (mL) **x factor** = Weight (gram). For example, the volume-weight factor for refined flour is 0.65. So, 150 mL rice flour makes 150 x 0.65 = 97.5 g rice flour.

Volume-weight factors for common foodstuffs

Foodstuff	Volume-weight **factor**
Large beans	0.75
Small beans and lentils	0.9
Rice	0.9
Refined flour	0.65
Whole grain flour	0.55
Groundnuts	0.75
Sesame seeds	0.65
Milk powder	0.45
Sugar, oil, milk, water	1.0

Measuring blood pressure

In life support we use the systolic blood pressure (not the diastolic) to assess the bloo circulation of injured persons. This is how you take the systolic blood pressure.

When the tap (T) is closed, you can inflate the cuff (C) by squeezing the bag (B). You can read the pressure inside the cuff on the manometer (M).

Use a small size cuff for children less than 8 years old.

Remove clothes and wrap the cuff tightly around the upper arm.

Before you inflate the cuff: Find the pulse beat at the elbow with your finger. This is the point where you should place the stethoscope.

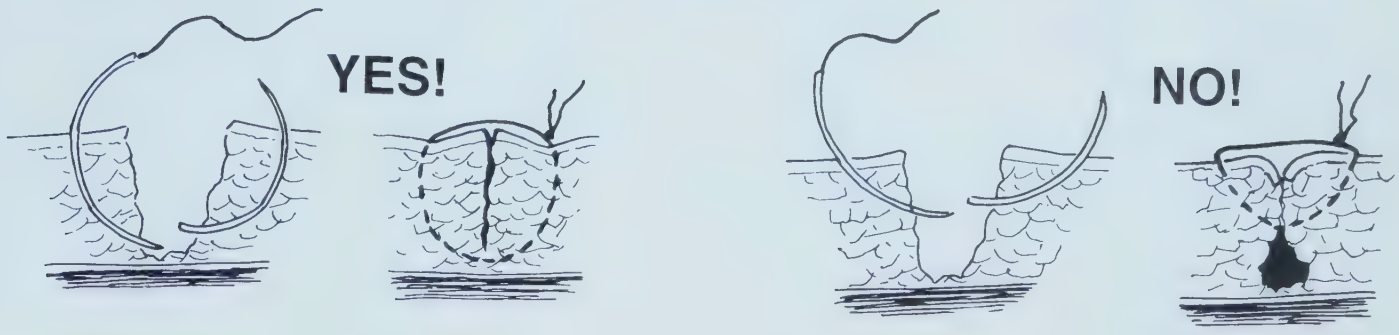
Place the stethoscope where you felt the pulse beat. Close the tap and inflate the cuff to 160-180 mm Hg. You cannot hear the pulse beats now.

Open the tap a little so that the air slowly slips out from the cuff. Listen carefully and look at the manometer when the cuff pressure is coming down: Note the pressure exactly whe you first hear the pulse beats again. That pressure is the systolic blood pressure.

Use the same technique in children – but use a smaller cuff.

The pulse beats are soft and weak if the blood pressure is low (the victim has lost a lot o blood). It is hardly possible to measure a blood pressure that is less than 60 mm in an adul Ask people around you to be silent, and take the blood pressure twice to be sure you go it right.

Sutures and surgical knots



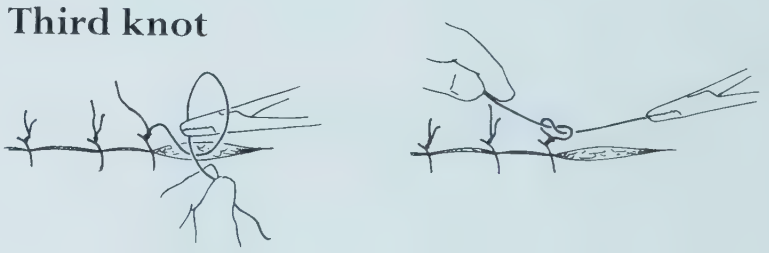
Suture technique

Drive the needle at a 90° angle to the skin surface. If not, the suture will depress the wound edges and create a pouch inside the wound where infection can develop. Don't tie the sutures very tight: hours after the suture, the wound edges will swell. Too much tension on the sutures will strangle the blood supply to the wound.

First knot

econd knot

Third knot



The standard surgical knot

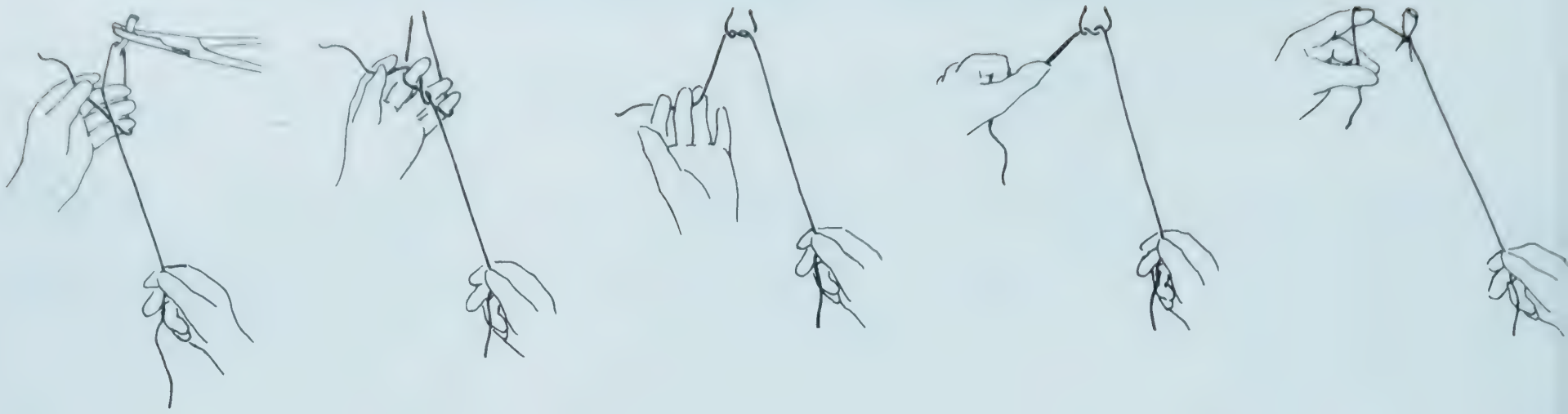
In tying the knot, pull the two ends of the suture parallel to the wound, not across the wound. This is to locate the knot at one side of the wound, not over the wound line. The standard knot is made of three knots: The first knot is straight and double. The second knot is reversed and single. The third knot is straight and single.

Never suture wounds from accidents

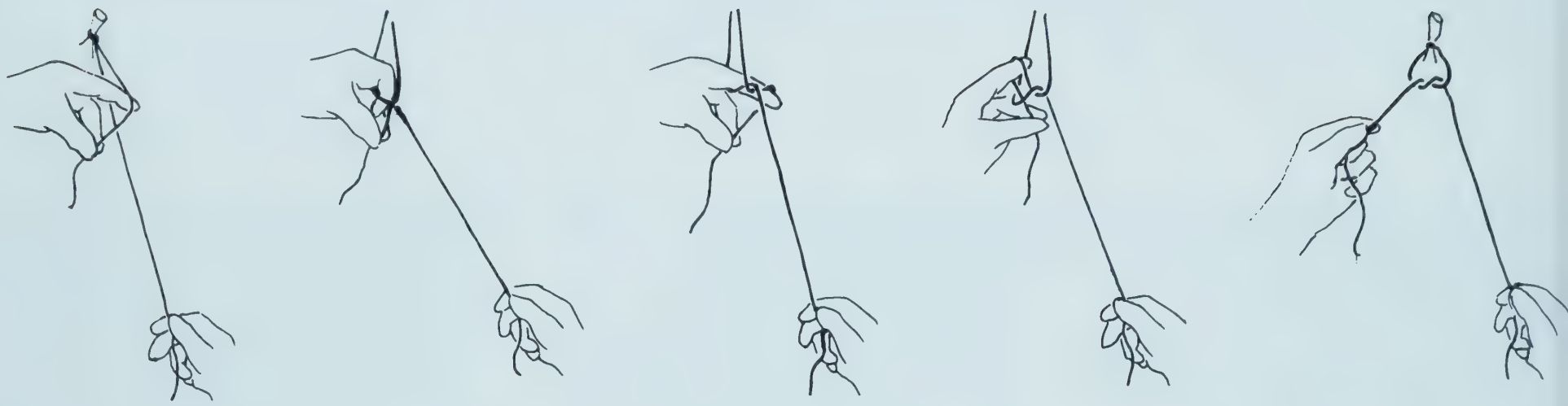
Wounds from accidents, mines, and bullets are always very dirty. If you close them by suture, the wound will become severely infected.

- Wash the wound with soapy water for 10 minutes.
- Leave the wound open, but covered with disinfected or clean gauze for 5 days so that the wound can clean itself.
- Then, wash the wound again. Pull the wound edges together with tape, the wound will grow by itself. Or take it to a doctor for suture.

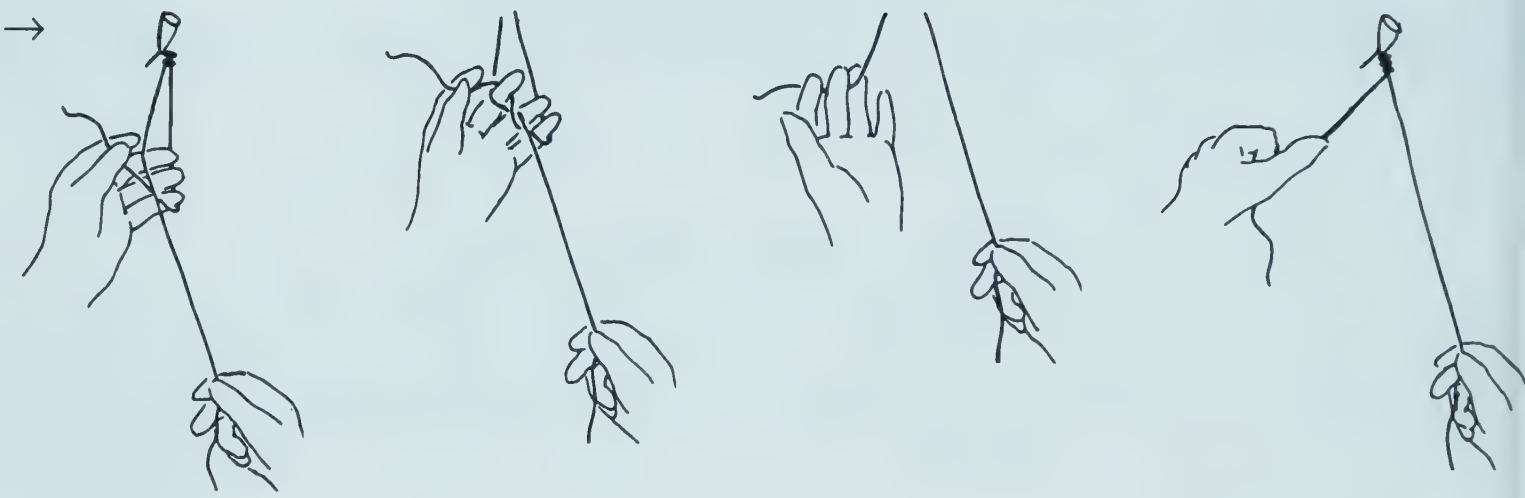
First knot →



Second knot →



Third knot →



The "one-hand knot"

The knot is used to tie off bleeding points deep inside wounds. You should not start on a laparotomy unless you can make the "one-hand knot" blindfolded. It is called a "one-hand" knot because one hand (the right hand if you are right-handed) is kept steady pulling the thread tautly at all times, and the other hand is used to tie the knot.

Diameter of cannulas, catheters and tubes

The diameter of some cannulas, catheters and tubes is sometimes given in **CH** (French: Charrière) or **G** (English: Gauge) – and not in **mm.** To avoid misunderstanding we should give volumes and sizes in **mL** (not cc) and **mm** (not CH or G) when we work with patients.

mm	CH	G
0.9		22
1.1		20
1.3		18
1.8		16
2.5	8	
3.0	10	
3.7	12	
4.5	14	
5.3	16	
6.0	18	
6.7	20	
7.2	22	
8.0	24	
8.5	26	
9.3	28	
10.0	30	
10.7	32	

As you can see from this table:
22 CH = 7.2 mm, whereas
22 G = 0.9 mm.

IV infusion speed

For a standard IV set, 20 drops are equal to 1mL of IV fluid (count in the drip chamber). From this table you can find out how fast the IV infusion should run, e.g. during the transport.

Drops per minute	equal to mL per hour of IV infusion
10	30
20	60
30	90
40	120
50	150
100	300

If you don't have what you need – use what you have

There is no reason to pay a lot for equipment such as plastic tubes from the pharmaceutica companies if you can make just as good copies at home. Good maintenance, improvisations and home-production help lower the running costs in our medical programs.

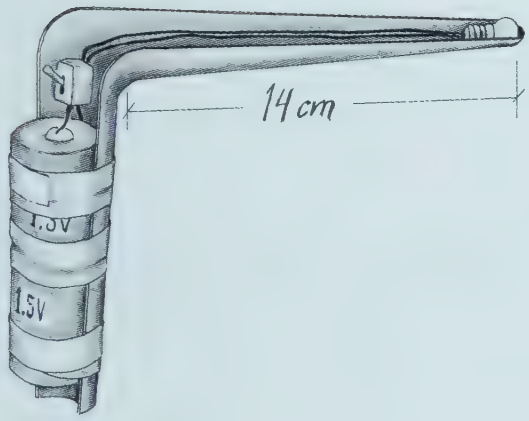
Maintenance

Stainless steel instruments have a special surface polish protecting them against corrosion If that polish is damaged, rusting starts. Rusting on one damaged instrument may sprea to other instruments during sterilization. Instruments that are not in use should b oiled weekly. Store the instruments in airtight boxes. Wrap each instrument in cloth o paper to protect against surface damage. Sharp instruments become blunt when they ar boiled repeatedly (disinfection with isopropanol is better). Use fine oiled grindstones, **no** grind-steel, to sharpen them. Use tailor's scissors, **not** surgical scissors, to cut sutures bandages, or clothes.

Rubber and plastic tubes

Store dry and air-tight. Rubber and soft plastic become sticky if stored in a moist state Rubber and plastic items become damaged after repeated boiling (isopropanol is bette for disinfection). If you re-use gloves: test them by blowing into them. Holes are close with patches from the inside.

Home-made copies



Home-made laryngoscope. For children the blade should be 11-12 cm long.

A clever mechanic with an equipped workshop can produce good and cheap copie of laryngoscopes, endotracheal tube-stylets, and most surgical instruments (scalpels needle-holder, forceps, retractors). Tell the mechanic that steel for surgical instrument should be hardened to Rockwell C35. Soft metal alloys are not suitable.

Suction catheters and stomach tubes

Buy some meters of plastic tubes at the market (diameter 4-5 mm). Cut pieces of 50 cm for suction tubes, 90 cm for stomach tubes. Heat the tube end and mold it to becom rounded, also cut a few small side-holes. Heat the other end and distend it so that it fit the suction connection.

Chest tubes

Also buy water tubes (diameter 6 and 10 mm) at the market. Cut side-holes at one end Distend or shrink the other end (heating) so that it fits the connection to the suction.

Suture materials

Threads of natural silk or linen/flax are excellent for sutures, ligatures, and for fixing tubes Soak the threads in sterile water or Ringer before use to make them less stiff. Thin nylo fishing cord may be used as well. Don't use cotton. Use cutting sewing needles (triangular pointed leather needles) for the skin and fascia.

Home-made wound retractor made from 3 mm stiff metal rod.

Instead of...

- Instead of gauze packs: Wrap layers of linen (not tightly woven) around a core of sof cotton.
- Instead of scalpel: Use any sharp knife at hand. Or razor blades on a pair of forceps.
- Instead of scissors: Use a knife.
- Instead of forceps and retractors: Use your fingers.
- Instead of orthopedic instruments: Use carpenter's saw. Bones can also be cut of without a saw: make small drill-holes around the entire bone at close intervals, an break the bone with your hands.

Severity Score for child victims

Normal values for children: See p. 72 and pocket folder at backcover.

The Severity Score for adult victims (see p. 36 and 193) does not work for children as it gives a false picture of how severe the injury is. The child's normal values of blood pressure and breathing rate are different from the adult's. Also children react differently to blood loss: they compensate for bleeding with increasing heart rate. Falling BP in a child is a late and dramatic sign. To get a true picture of the injury in children less than 12 years old, you should use the Pediatric Trauma Score.

Pediatric Trauma Score (PTS)

	+ 2	+ 1	- 1
body weight	more than 20 kg	10-20 kg	less than 10 kg
airway	normal	moderate obstruction of oral airway	obstructed or intubated
systolic blood pressure	more than 90 mm Hg	50-90 mm Hg	less than 50 mm Hg
conscious level	completely awake	moderate loss of consciousness	deep unconsciousness
open wound	none	small	large or deep
fractures	none	small	open or several
TOTAL			

A full PTS (healthy, uninjured child) is 9-12. Any injured child with a PTS of 7 or less is in danger: give immediate life support, and watch closely during transport to the hospital.

Example of scoring: A 5-year-old girl with body weight 15 kg (score +1) is injured in a traffic accident. You see her 10 minutes after the injury and find: she is drowsy but opens the eyes when you talk to her (score +1); airway open (score +2); BP 80 mm (score +1); open fracture at the thigh (open fracture: score -1). She scores a total of 4 at the injury site. When she gets to the hospital after IV volume treatment and ketamine pain relief during the transport, she is completely awake (score +2) with a BP at 90 mm (score +2). She scores 6 at hospital admission: the life support has been efficient.

Analyze your results

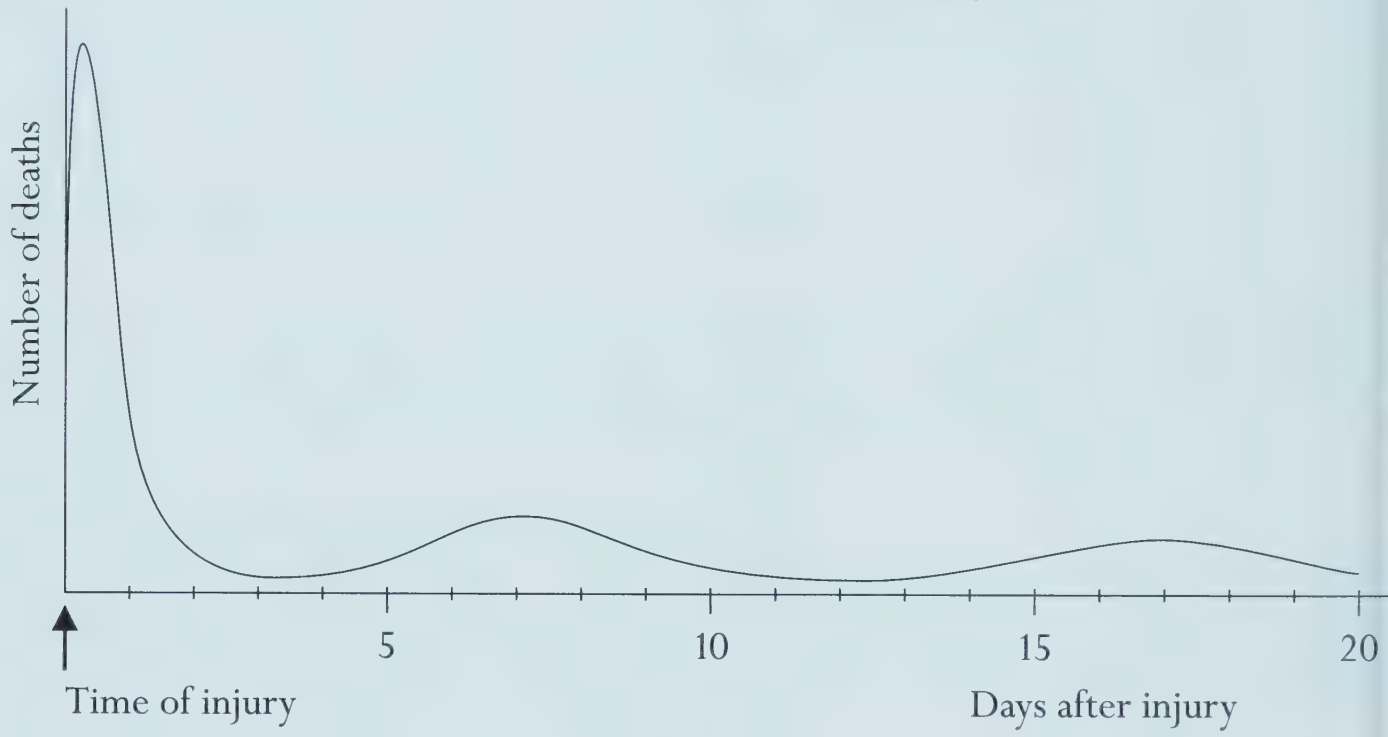
A variable is a changeable, not constant, factor which can affect the outcome in our patients. For example: type of mine, blood pressure before treatment, transport time, and other factors that we can measure.

Let's say we want to analyze the effect of prehospital life support on the outcome. Or, w want to compare the results of our chain of survival with the results of prehospita trauma systems in other areas or other countries. Or we want to publish a paper in a medi cal magazine that sums up the experiences we have. First we have to define **indicator of outcome,** and also define **prehospital variables** that could affect the outcome. The we study the relation between different variables, and the outcome indicators. Simpl analysis can be done with calculator (see p. 173). If you have a large group of patients an want to do more than a rough analysis, you need to do some statistical calculation Simple and efficient computer programs for medical statistics are available for mos PCs (see below).

One indicator of outcome: Death

- Prehospital deaths (Yes, or No): Dead before admission at hospital.
- Time of prehospital death: Register in half-hours from the time of injury.
- Hospital death (Y/N): Those dying within 30 days after the injury from reasons relate to the injury.

Number of deaths in relation to time after the injury



Deaths due to injury are grouped in three peaks: The majority of dying victims di within a few hours after the injury (the first peak of the graph). Most of them die due t blood loss and/or airway block. The next peak of deaths is for those who die at the hospi tal from infectious complications 5-10 days after the injury. The third peak represent those who die from organ failure secondary to infectious complications. Our main interes in quality studies is to see if we can reduce one, two, or all three peaks by early and goo life support.

Another indicator: Effect of life support

Severity Score:
See p. 36 and 80.

To measure the effect of in-field life support, we should first grade the effect of the injur on the victim's body – that is, **the physiological severity** of the injury. There are seve ral scoring systems for physiological severity. We (the authors) use a Severity Score (SS which is a simplified version of the Revised Trauma Score (RTS). The SS grades th breathing and the circulation in the same way as the RTS. But the scoring of conscious level differs: The SS uses a simple scale: *Awake – confused – responds to sound – responds to pain onl – no response.* The RTS uses the Glasgow Coma Scale to grade the conscious level.

The Glasgow Coma Scale (GCS)

	Score
Eyes open	
Spontaneously	4
To verbal command	3
To pain	2
No response	1
Best movement response	
Obeys verbal commands	6
Painful stimulus: Localizes pain	5
Painful stimulus: Flexion – withdrawal	4
Painful stimulus: Flexion – abnormal	3
Painful stimulus: Extension	2
Painful stimulus: No response	1
Best verbal response	
Oriented and talks	5
Disoriented and talks	4
Inappropriate words	3
Incomprehensible sounds	2
No response	1
Total	3-15

Revised Trauma Score (RTS)

	Score: 4	Score: 3	Score: 2	Score: 1	Score: 0
Breathing rate/minute	10-29	>29	6-9	1-5	0
Systolic BP (mm Hg)	>89	76-89	50-75	1-49	0
GCS	13-15	9-12	6-8	4-5	3
Total					

Regardless of which scale you use for physiological scoring, you can calculate the effect of prehospital treatment by comparing the score in the field **before treatment (S1)** with the score **at hospital admission (S2).** Register the difference or $\Delta S = S2–S1$. If ΔS («delta s») is 0 or positive, you have been able to stabilize or improve the physiological condition during the evacuation: "positive effect of treatment". Negative ΔS means "negative effect of treatment". Note: "Negative effect" does not necessarily mean that the treatment has worsened the condition of the patient. But the effect of treatment was not enough to compensate for the physiological damage caused by the injury. Nor does "positive effect" necessarily mean that the result is only an effect of the treatment given.

Hospital indicators of outcome

Record the main complications exactly and according to international definitions.

Number of surgical operations in limb-injured cases

In uncomplicated cases, there are two operations: first, debridement of the wound; second, wound closure. More than two operations indicates complications.

Infectious complications

- Wound infection – one of three signs: (1) local inflammation; (2) local pus; (3) local gas production.
- Pneumonia – two of three signs: (1) fever; (2) productive coughing; (3) new densities on chest X-ray.

- Peritonitis – three of five signs: (1) fever; (2) tender abdomen; (3) abdominal withdrawa pain; (4) abdominal wall rigidity; (5) poor or absent bowel sounds.
- Septicemia – three of six signs: (1) fever >39° C; (2) wound infection or abscess; (3 increased breathing rate; (4) warm and dry limbs; (5) heart pump failure with circulator shock; (6) bacterial growth in blood culture.

Organ failure

- Adult respiratory distress syndrome (ARDS) – four of five signs: (1) major injury o surgery; (2) increased breathing rate; (3) hypoxemia (low blood oxygen); (4) new patchy densities on chest X-ray; (5) no signs of heart pump failure.
- Renal failure – two of three signs: (1) major injury or surgery, but not to the kidneys (2) urine production <0.5 mL/kg body weight/hour that does not increase wit volume treatment; (3) increasing serum creatinine.
- Heart failure – all three signs: (1) major injury or surgery, but not to the heart; (2) lun congestion; (3) systolic BP <90 mm Hg without hypovolemia (lack of blood).
- Disseminated intravascular coagulation (DIC) – four of five signs: (1) major injury o surgery; (2) increased general tendency to bleed; (3) reduced clotting time (clotting test) (4) platelet count <100 x 10 cells/L; (5) no hypothermia (low body temperature).
- Liver failure – both signs: (1) major injury or surgery, but not to the liver; (2) clinica jaundice.
- Multi-organ failure – both signs: (1) major injury or surgery; (2) failure of two or mor organ systems (see above).

End-point indicators of outcome

The end-point for survivors is the time when they are out of the hospital and the re habilitation program is finished. End-point studies should at the earliest be done nin months after the injury. End-point values are estimates of function based on what th patient himself tells you in interviews. If the patient is confident and honest, such self-ratin of health gives the most reliable picture of his health and function.

Patients' self-rating

Draw a line from 0 to 10 (zero = very poor, 10 = excellent, without problems), an ask the patient to mark with a cross on that line how he rates his own function. Som questions you could pose:

- How would you rate your general health now as compared to before the accident?
- How would you rate your health now as compared to neighbors of your age?
- To what extent does pain prevent you from doing things you like to do?
- How would you rate the psychological problems you have after the accident?

Prehospital variables

The time factor

- The time from injury to the start of first helper assistance (ΔT1)
- The time from injury to the start of medic assistance (ΔT2)
- The time from injury to hospital admission (ΔT3)

The weapon or type of injury

The variables you select depend on the setting. Below are the main groups and subgroups

- Mines: light blast mine; heavy blast mine; fragmentation mine; bounding fragmentatio mine; fuse; improvised mine; anti-tank mine; unknown mine.
- Gunshots: low-velocity weapons (pistols); high-velocity weapons (rifles).
- Other penetrating war injury (fragments from artillery/rockets/bombs.
- For mines, gunshots, and artillery: the range from the explosion/barrel to the patient
- Other blunt war injuries: bomb blast; underwater explosion.
- Other penetrating injuries: stab wounds; bites; others.
- Blunt injuries: traffic accidents; other blunt injuries.

The diagnosis of the injury

The groups and subgroups are as follows:

- Superficial injury (wound tracks not penetrating the muscle fascia).
- Injury to the head/face/neck.
- Injury to the chest.
- Injury to the abdomen/pelvis.
- Amputations (classify the amputation level).
- Other limb injury: vascular injury; compound fracture; tourniquet.
- Multiple major injuries to the limb plus trunk/head; multiple injuries to the trunk/head.

Factors that complicate injury

- Malnutrition none; moderately undernourished; severely undernourished.
- Diseases: the most common endemic diseases in the area.

The treatment

- First helper assistance recovery position; stop the bleeding; warming; nutrition.
- Medic treatment at the site and during the transport: for the common life support measures, see Injury Chart p. 81.

Physiological severity

See severity scoring above. Low body temperature is also a prehospital variable of interest. Consider recording the rectal temperature at hospital admission.

Anatomical severity

The Injury Severity Score (ISS) is the most frequently used method to grade the severity of the anatomical injuries. To calculate ISS, you need very exact hospital diagnosis based on X-ray examinations and surgery. And you need a special table ("Abbreviated Injury Scale 1990", AIS-90) where each anatomical diagnosis is given a specific severity value. From the AIS-90 table you can identify the three most "severe" diagnoses in each patient, and calculate the total ISS for that patient. ISS values range from 1 to 75. By definition a severely injured victim is one with ISS >15. Note: You don't need ISS grading to monitor the quality of your own trauma system. For that, grading of physiological severity is good enough. But international standards of good performance are based on both physiological scoring and ISS grading of patients. So, if you like to compare the outcome of your trauma system with international standards, or if you are going to publish your results, you should consider doing ISS grading of your patients. Or else somebody might turn you down simply by saying: *They have good results, OK. But that's probably because they have light cases only.*

Outcome analysis using computer statistics

The study of relations between prehospital variables and indicators of outcome (prehospital, hospital and end-point indicators) is best done on a PC with a program for medical statistics. Several programs are available, many of them are big and can only be operated on PCs with large capacity. We recommend EPI Info 6, a small and efficient program developed and distributed for free by WHO. EPI Info is specially designed to study diseases, injuries, and malnutrition in groups of patients.

EPI Info in brief

1. Study the manual carefully. It includes exercises for you to learn the basics of medical statistics, and to learn to operate the program.
2. Design a registration chart that includes patient ID numbers, all variables you want to study, and all outcome indicators you have registered. Test the chart on a few patients to check that it is complete, that all variables you want to study can be registered.
3. Enter the patient data into the chart. The program makes one file for each patient.
4. Now you can analyze the data for the whole group of patients, or you can select subgroups for a closer study. The results are given as tables or graphs.

ou can get AIS-90 and more nformation from the authors.

or EPI Info 6 you need an IBM ompatible PC, minimum 512 B internal memory, with MS-OS.

PI Info 2000 is under way, it is Vindows operated. Contact VHO: See address list p. 207.

5. You can also merge two or more EPI Info registration charts into one: Data from separate groups of patients in other areas or countries can be integrated into one large group of patients. The larger the group of patients, the more valid are the results of the analysis. You can also export data from EPI Info for analysis and printing in other statistical programs (e.g. Windows Excel).

Examples of using EPI Info for outcome analysis

From 1997-98 we (the authors) used EPI Info 6 to register variables and outcome indicators on a group of 363 mine victims. Here are a few examples of EPI Info tables that gave us valuable information.

SS 1	Freq	Percent	Cum.
0	56	15.2%	15.2%
1	1	0.3%	15.5%
2	1	0.3%	15.8%
3	1	0.3%	16.0%
4	4	1.1%	17.1%
5	4	1.1%	18.2%
6	8	2.2%	20.4%
7	9	2.4%	22.8%
8	6	1.6%	24.5%
9	35	9.5%	34.0%
10	43	11.7%	45.7%
11	63	17.1%	62.8%
12	137	37.2%	100.0%
Total	368	100.0%	

Total	**Mean**	Variance	Std Dev	Std Err
368	**8.921**	17.680	4.205	0.219

This table to the left shows a mean Severity Score of 8.9 before treatment started in the field. This was 2.7 hours after the time of injury (see table to the left bottom). The standard deviation (Std Dev) is high, indicating a wide spread of the SS1 values around the mean value.

DELAY SS1 (hours)	Freq	Percent	Cum.
0.5	132	36.4%	36.4%
1.0	55	15.2%	51.5%
1.5	27	7.4%	59.0%
2.0	26	7.2%	66.1%
2.5	20	5.5%	71.6%
3.0	17	4.7%	76.3%
3.5	8	2.2%	78.5%
4.0	14	3.9%	82.4%
4.5	8	2.2%	84.6%
5.0	11	3.0%	87.6%
5.5	8	2.2%	89.8%
6.0	5	1.4%	91.2%
6.5	3	0.8%	92.0%
7.0	1	0.3%	92.3%
7.5	1	0.3%	92.6%
8.0	5	1.4%	93.9%
8.5	2	0.6%	94.5%
9.0	1	0.3%	94.8%
10.0	3	0.8%	95.6%
10.5	2	0.6%	96.1%
11.0	4	1.1%	97.2%
12.0	1	0.3%	97.5%
14.5	1	0.3%	97.8%
16.0	1	0.3%	98.1%
17.0	1	0.3%	98.3%
17.5	1	0.3%	98.6%
22.0	1	0.3%	98.9%
23.0	1	0.3%	99.2%
27.0	1	0.3%	99.4%
36.0	1	0.3%	99.7%
48.0	1	0.3%	100.0%
Total	363	100.0%	

Total	**Mean**	Variance	Std Dev	Std Err
363	**2.731**	20.257	4.501	0.236

DELAY DEATH	Freq	Percent	Cum.
0.5	**40**	71.4%	71.4%
1.0	**4**	7.1%	78.6%
1.5	**2**	3.6%	82.1%
2.0	**1**	1.8%	83.9%
3.0	2	3.6%	87.5%
5.0	1	1.8%	89.3%
6.0	2	3.6%	92.9%
21.0	1	1.8%	94.6%
120.0	1	1.8%	96.4%
190.0	1	1.8%	98.2%
220.0	1	1.8%	100.0%
Total	**56**	100.0%	

The table above shows that 56 of the 363 mine victims died. The majority (40+4+2+1=47) died within two hours after the injury.

The table to the left shows that the mean delay from the time of injury to the time when the medic first saw the victim was 2.7 hours. At that time 47 of the victims were dead already.

Conclusion: train more medics and more village first helpers.

Current selection: SS1>SS2

DELAY DEATH	Freq	Percent	Cum.
0.5	2	18.2%	18.2%
1.5	2	18.2%	36.4%
2.0	1	9.1%	45.5%
3.0	**2**	18.2%	63.6%
5.0	**1**	9.1%	72.7%
6.0	**1**	9.1%	81.8%
21.0	1	9.1%	90.9%
220.0	1	9.1%	100.0%
Total	**11**	100.0%	

Current selection: SS1>SS2

ANAT DIAGN	Freq	Percent	Cum.
head/neck	1	5.9%	5.9%
abdomen	1	5.9%	11.8%
comp fract	**2**	11.8%	23.5%
other limb	**4**	23.5%	47.1%
multi torso	3	17.6%	64.7%
torso-limb	6	35.3%	100.0%
Total	**17**	100.0%	

The two tables above show data for the group of patients who became worse during the transport (SS1>SS2), a total of 17 of 363 patients.
Table left: The death toll in this group is high, 11 of the 17 died. 4 of the fatalities happened 3-6 hours after the injury, at a time when the patients should be under treatment by an experienced medic. So, what went wrong?
Table right: 6 patients in this group had injuries to the limb only. It should have been possible to stabilize these 6.
Conclusion: Study these 7 Injury Charts carefully to see if any of those deaths could have been avoided.

Current selection: DEATH= "Y"

AMPUTLEVEL	Freq	Percent	Cum.
ankle	**3**	8.8%	8.8%
dist. lowleg	**4**	11.8%	20.6%
prox. lowleg	**7**	20.6%	41.2%
knee	2	5.9%	47.1%
dist. thigh	1	2.9%	50.0%
mid thigh	3	8.8%	58.8%
prox. thigh	2	5.9%	64.7%
torso	2	5.9%	70.6%
hand	**2**	5.9%	76.5%
wrist	**7**	20.6%	97.1%
elbow	1	2.9%	100.0%
Total	**34**	100.0%	

Current selection: death="Y" and amputation=Y

ANATDIAG	Freq	Percent	Cum.
multi limb	5	17.9%	17.9%%
torso-limb	**23**	82.1%	100.0%
Total	28	100.0%	

Table left: 34 mine victims with amputation died. 23 of them had amputations below the knee or below the elbow, that is, amputation wounds that normally bleed less. So why did they die?
Table right: 28 of the 34 dead amputees had also fragment injuries. 5 of them had fragment wounds on the other limb. 23 of them had fragment wounds to the torso (head/neck/chest/abdomen). So, the main problems in these victims were probably the fragment injuries, not the amputation wound. We could confirm that when we studied the Injury Charts of this group.

Applying for funding

Governments and institutions in the rich countries, and also UN agencies have a special set-up for project descriptions and project budgets. If you do it "their way", you are more likely to get support and funding. Here are the standard subtitles for a project description with our comments:

1. **Project title**
   As an example: "Mine Victim Assistance: Prehospital life support for victims of injury with special reference to landmine victims."
2. **Objectives**
   To build a sustainable network outside hospitals to assist all victims of injury, and especially landmine victims. Give the main arguments why such a network will reduce the loss of lives and limbs, and also improve the treatment for patients with emergency medical problems.
3. **Target groups**
   Describe the area and the population where you are running your project. Explain why this area was selected. If you have done a mapping of mine injuries in the area, give the results here.
4. **Indicators**
   "Indicators" are the things you should look for to measure exactly the results of the project. First, explain how you will document the medical treatment: The Injury Chart and the Hospital Chart. Then, set up a list of indicators for success. In prehospital life-support projects like ours, these may be indicators:
   - Saving lives (the death rate). Give an estimate (%) of how many die from mine injuries at present. And how you will sum up the death rate at intervals during the project period to see if it comes down.
   - Saving limbs and reducing complications. Give an estimate (%) of how many have problems with wound infections and other complications at present. Explain how you will check the rate of complications during the project period.
5. **Implementation**
   Give a brief description of the project organization:
   - The project leaders, instructors, and supervisors. Cooperation with local authorities.
   - Training a core group of (20-25) health workers for 300-450 hours in modern medical life support. Describe how the trainees are selected.
   - Describe how the core group also will be trained as medical instructors so that they can provide training in basic first aid to lay-people at village level in order to build a wide network of first helpers.
   - Describe the cooperation with the local surgical hospital (and NGOs if any).
6. **Time-frame** (below is an example.)
   Year 2000: Selection of 20 health workers for the first of three 100 hours' training courses. Training 500 village first helpers. Investments: teaching aids and medical kits. Milestone: The first training course.
   Year 2001: The second of three 100 hours' training courses. Training 1,000 village first helpers. Investments: teaching aids for airway management. Supplements for medical kit. Milestone: The second training course.
   Year 2002: The third and final 100 hours' training course. Training 1,000 village first helpers. External evaluation of the project. Milestone: The third training course.
7. **External factors**
   List factors (outside your control) that may disturb the running of the project. Such factors can be local political conflicts or wars; inflation (project costs may increase more than expected); trading sanctions that affect the medical supply. Be generous in listing "external factors". If you get problems under way, you can tell the funders: *Look at the project description, I already told you this might become a problem. So, there is no reason for you to back off.*

"Milestone" means the most important event to do that year. When you give yearly reports to the funders, they can check the project's progress by seeing if the "milestones" follow the time-frame.

8. **Quality control**
   Explain how you will use the indicators to continuously check the effect of the project. If you know some reliable and friendly medical professionals, list their names and explain that they will be invited to do a final evaluation of the project when it is finished.
9. **Sustainability**
   Explain how the activities can be funded when the project period is finished (stress that the project is low-tech and low-cost). Explain how the medical network of this project will be integrated in the local health infrastructure in cooperation with the local health authorities.
10. **Reports**
    Status reports will be given yearly during the project period.

Budget form

Set up separate budgets for investments and running costs. The figures in the budget below are only an example (notice increasing running costs due to inflation). Notice that most funders set a limit for administration costs at 10% of the total project costs. Some funders also demand that 20% of total project costs should come from local sources or directly from the implementing agency. This is easily arranged by listing some of the costs for administration as local contributions/gifts, or by setting the prices of medical items slightly higher than real market prices.

VESTMENTS

		2000	2001	2002	Total
aching aids	2 dummies for CPR	4,000	–	–	4,000
	1 dummy (airway trainer)	–	1,000	–	1,000
edical items	20 medical kits	20,000	5,000	–	25,000
dministration	1 motor bike	3,000	–	–	3,000
	telephone and fax	500	–	500	1,000
tal investments		**27,500**	**6,000**	**500**	**34,000**

UNNING COSTS

		2000	2001	2002	Total
dministration	salaries	10,000	12,000	14,000	36,000
	office costs	3,000	3,500	4,500	11,000
	transport	2,000	3,000	4,000	9,000
edical training	100 hours' training course	8,000	10,000	12,000	30,000
	village first helper training	3,000	4,000	5,000	12,000
	meetings and refresher training	2,000	3,000	4,000	9,000
edical treatment	medical items	12,000	14,000	16,000	42,000
	transport of patients	1,000	1,500	2,000	4,500
ality control	medical documentation	2,000	3,000	4,000	9,000
	back-up persons	5,000	6,000	7,000	18,000
	external evaluation	–	–	12,000	12,000
foreseen expenditures		5,000	5,000	5,000	15,000
tal running costs		**53,000**	**65,000**	**89,500**	**207,500**
tal costs (investments + running costs)		**80,500**	**71,000**	**90,000**	**241,500**

Request for funding

FINANCE PLAN

	2000	2001	2002	sur
1. Total project costs	**80,500**	**71,000**	**90,000**	**241,50**
Estimated funding from UNICEF Phnom Penh	20,000	20,000	20,000	60,00
Support from Catholic Relief Services, Battambang	6,000	6,000	6,000	18,00
Support from local sources	16,000	16,000	16,000	48,00
2. Total present funding	**42,000**	**42,000**	**42,000**	**126,00**
Need for funding (1-2)	**38,500**	**29,000**	**48,000**	**115,50**

Names and figures in this finance plan are fake. But the conclusion would be somethin like this: Our organization "Support Mine Victims" therefore requests WHO to suppor our mine victim assistance program with a total sum of 115,500 according to the budge and finance plan above.

Teaching aids

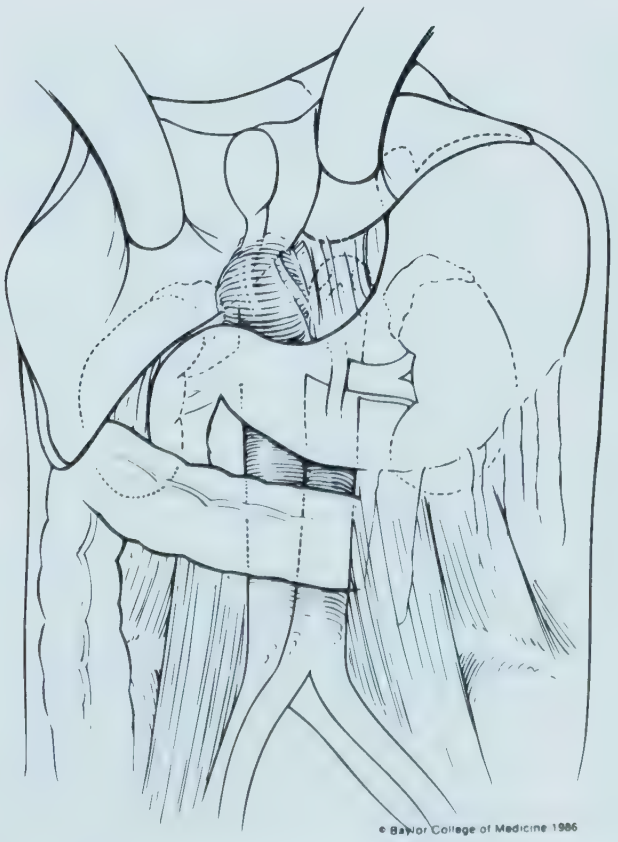
Requirements for good teaching aids:
- Acceptable to the local people
- Low-cost and efficient
- Something that local people can easily understand, and repair by themselves
- Make full use of local resources and abilities
- Take into consideration any local factors such as transport conditions, climate, hygiene
- Help the local community to gain greater control and become more self-reliant.

You don't need to order expensive teaching manuals and training dummies from abroad – most teaching aids can be found or made locally. Besides, we learn more and become more self-confident by solving problems and making things ourselves.

Pictures: lifelike and home-made is better

t so good: The message in this drawing is correct, t the people look like pink dolls. A poor farmer the South would hardly think: *this is something me.*

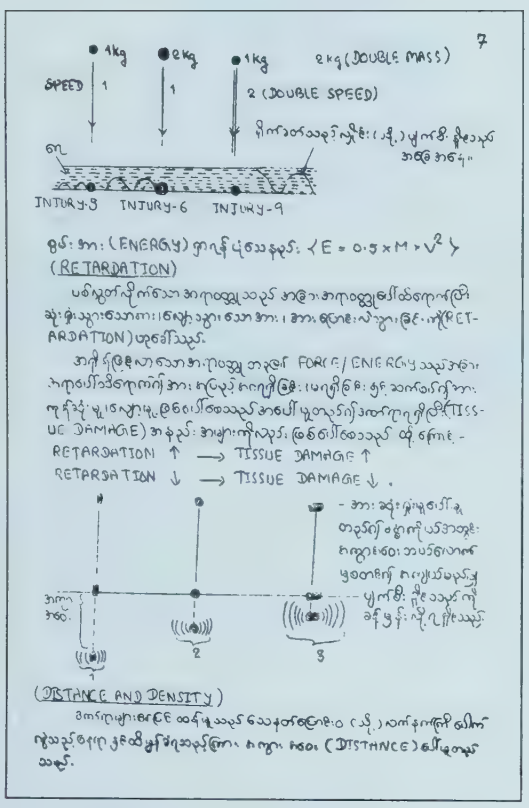
This is good: The drawing is made by a local Cambodian artist in cooperation with experienced mine medics. Villagers will think: *They are just like us.* That's a good start in learning life support.



Which one is better for a village health worker – this one? (From a medical text book, price US$90.)

Or this one? Drawings should be lifelike, not abstract. Even better is to draw on people, not on paper – both anatomy and injuries.

Do it yourself: Pictures are doubly effective if the students at the Village University – or villag first helpers – help to make them. Keep them linked in a chain or as flip charts for better orde For each drawing you can write guidelines for the instructor on the back of the previous page.



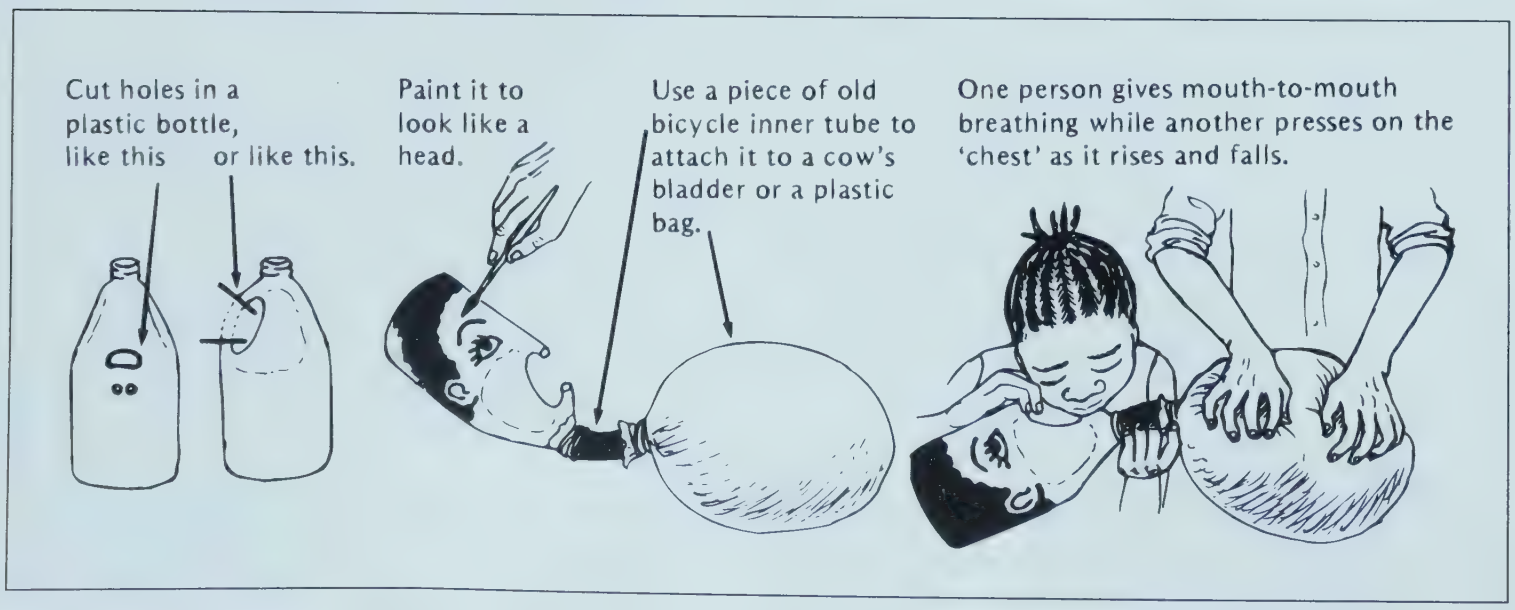
This is a manual in war surgery made by three experienced medics from the Burmese resistance

Make your own teaching manuals

You are free to translate, adapt, and copy any part of *Save Lives, Save Limbs.* We are sure tha your people will learn more from local versions that target specific local needs than fro this English edition. We have a few suggestions that may be of help:

- **Content and size:** *Save Lives, Save Limbs* is comprehensive. It is meant for village lay people, for village health workers, for nurses and doctors at district hospitals, fo social workers, and people engaged in medical relief. Written for so many groups, tha has made the book too large. It is not easy for marginal readers to find what they nee So choose what is useful, add what you need – and you can make several smalle manuals.
- **Language:** A manual is good only when it is written in the local languages. You wi probably have to find or invent good and simple words for medical terms like "bloo circulation" (blood flow?) and "CPR" (reviving the lifeless?).
- **Writing style:** Use the spoken language of the people and avoid big words. We are sur you can do that better than us university doctors. Keep sentences short. Use man headings to divide up the text. Good drawings tell more than hundreds of words.
- **"Vietnamese farmers":** The founder of modern Vietnam, Ho Chi Minh, alway tested important speeches on a few farmers before he gave them to the public. If th message did not get across to the farmers, Ho would rewrite the speech. So should yo before your own manuals go for printing.

Teaching aids for basic life support

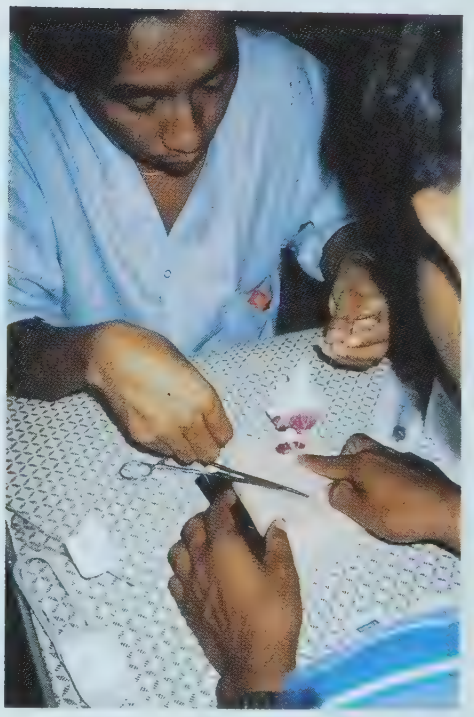


Make your own CPR-trainer. You can learn the practical details on this one, and even more in making it. (From Werner and Bower: *Helping Health Workers Learn*).

aining in CPR on Laerdal ® dummies. They are good but pink, cold, and expensive.

This is just as good – if not better.

Learning to fix cannulas and tubes with suture. Which one is better – this one? Life-like, cheap and efficient.



Or this one? Plastic, dead, and expensive.

To train in intubation, you need a dummy: The larynx of animals is so different from ours. This is Laerdal's *Airway Manager* ®.

For chest tube placement there are no dummies available. But there is no better model than an animal, dead or alive.

Books for further studies

We base this assessment on four questions:
- Is the book useful for life support for the wounded outside hospital?
- Is the book useful for doctors and nurses at small district hospitals?
- Is the book out-dated or up to date? Does it view the wounded body as made up of separate organ systems – or does the book instead promote understanding of how the wounded body as a whole defends itself when injured?
- Is the book expensive (more than US$50) or cheap (US$20 or less)?

Books on the landmine epidemic

McGrath R: **Landmines and Unexploded Ordnance – A Resource Book**
Pluto Press. London 1999.
Good, comprehensive and outspoken book on mine action (surveys and clearance techniques) and the impact of the mine epidemic on the local communities. The book examines critically the response by international organizations to the mine problem, and discusses community-based responses for recovery. Contains a useful section on contacts and network addresses. Language: simple. Price: cheap.

Davis P and Dunlop N: **War of the Mines.**
Pluto Press. London and Colorado 1994.
An in-depth, well-illustrated study of the landmine problem in Cambodia. Useful for health workers with less knowledge of mine-infested communities. The sections on mine injury and death are an example of city-based analysis of a rural problem that typically underestimates the extent of the problem. Language: simple. Price: cheap.

Books on life support

Robertson C and Redmond A D: **Major Trauma.**
Oxford University Press. Oxford-New York-Melbourne 1994. 190 pages, few illustrations.
Good and updated book on life support outside and inside hospitals. The writing style is relatively simple, discussions are to the point. Price: cheap.

Skinner D, Driscoll P and Earlam R: **ABC of Major Trauma.**
BMJ Publishing Group. London 1996. 150 pages, a lot of illustrations.
Updated manual on life support at well-equipped hospitals. Not useful in Third World countries. Writing style: complicated. Price: expensive.

Books on life-saving surgery

Dufour D and others (et al.): **Surgery for War Victims.**
International Committee of the Red Cross. Geneva 1990. 220 pages, few illustrations.
Old-fashioned in life support outside and inside hospital. Readable but not updated on amputations. The particular problems associated with mine injuries are not discussed. Good on fragmentation injuries, in particular, chest injuries. Writing style: complicated. Price: low.

Husum H, Ang S C, and Fosse E: **War Surgery, field manual.**
Third World Network. Penang 1995. 760 pages, 1,400 illustrations.
Good and updated book on life support, nutrition, and life-saving surgery at district hospitals, less useful outside hospitals. Useful on organizing injury care in Third World countries. Writing style: rather simple. Price: cheap if ordered direct from the publisher.

Trueta J: **Principles and Practice of War Surgery.**
CV Mosby Company. St. Louis, USA 1943. 440 pages, good illustrations.
Despite its age, this is still one of the best teaching manuals on injury care and surgery.

Useful outside and inside hospitals. Writing style: simple. Price: the book is no longer in print, order it from a library and copy it.

King M and others (et al.): **Primary Surgery, Volume 2: Trauma.**
Oxford University Press. Oxford-New Delhi-Kuala Lumpur 1986. 300 pages, a lot of illustrations.
Good book on surgery for district hospitals written by experienced African doctors. Not very useful for life support outside the hospital. Writing style: simple. Price: low.

Rutherford W H: **Accident and Emergency Medicine.**
Dandy D: **Essentials of Orthopaedics and Trauma.**
McRae R and Kinninmonth A: **Illustrated Orthopaedics and Trauma.**
McNair H: **Hamilton Bailey's Emergency Surgery.**
Ivatury R and Cayten C G: **Penetrating Trauma.**
We can learn something from all books. Although these books were printed recently, they have not been updated on life support. They are meant for well-equipped hospitals, written in a very difficult style, and are all expensive.

Books on anesthesia

King M with more: **Training Anaesthesia.**
Oxford University Press. Oxford 1986.
Well-illustrated and useful teaching book for simple techniques of anesthesia at rural hospitals. Writing style: simple. Price: low (for the Third World edition).

Dobson M B: **Anaesthesia at the District Hospital.**
World Health Organization. Geneva-New Delhi 1989. 140 pages, a lot of illustrations.
Good book for local and general anesthesia at hospitals with simple equipment. Also useful for life support techniques, but not quite updated. Writing style: simple. Price: low.

Books on medical education

Werner D and Bower B: **Helping Health Workers Learn.**
The Hesperian Foundation. Palo Alto, USA 1991. 450 pages, a lot of helpful illustrations.
Excellent book on methods, teaching aids, and ideas for medical instructors and health care organizers at the village level. Writing style: simple. Price: cheap.

Werner D and Sanders D: **Questioning the Solution.**
Health Wrights and Third World Network. Palo Alto, USA and Penang, Malaysia 1998.
Good guide in organizing rural health care systems. The book discusses the problems of cooperating with the large international relief organizations. Good discussions on oral volume treatment including do-it-yourself diets for rehydration and nutrition. Price. Cheap.

Useful contacts

Health Wrights
P O Box 1344
Palo Alto CA 94302
USA

Tel +16 503 257500
Fax +16 503 250180
Email healthwrights@idc.org

Workgroup and coordinating center for rural health programs and medical education. Coordinating center for International People's Health Council (see below). Distributes pamphlets and several useful books: *Where there is No Doctor. Helping Health Workers Learn. Questioning the Solution. Nothing About Us Without Us.*

The International People's Health Council

Maria Hamlin Zuniga, CISAS
Apartado # 3267
Managua
Nicaragua

David Sanders
UWC Public Health Program
P. Bag X17
Capetown 7535
South Africa

Mira Shiva
A-60 Hauz Khas
New Dehli, 110016
India

Ricardo Loewe
PRODUSSEP
Kramer 71
Col. Atlantida
Coyoacan, Mexico D. F.
Mexico

David Werner
See: Health Wrights (above)

A South-North network working for the health and rights of disadvantaged and poor people. It is open to all people and groups involved in grassroots struggles for health and medical education.

Tromsoe Mine Victim Resource Center (TMC)
P. Box 80
9038 Tromsoe University Hospital
Norway

Tel +47 77 626227
Fax +47 77 628073
Email tmc@rito.no

The center coordinates research and training programs for prehospital mine and war victim assistance. It is also a support center for Trauma Care Foundation (see below). Distributes teaching aids, photo documentation and books *War Surgery, Field Manual.* And also *Save Lives, Save Limbs.*

Trauma Care Foundation (TCF)

TCF Cambodia
Mr. Yan Van Heng
Battambang.
Tel +855 53 370 168

TCF North Iraq
Dr. Mudhafar Kareem Murhad
Suleimaniah
Tel +873 385 051212
Fax +873 385 051211

TCF Angola
Mr. Silva Chissacanga
Luena
Tel +873 761 610584
Fax +873 761 610585
Email skasack@compuserve.com

TCF coordinates local mine victim assistance programs, provides medical teachers, and helps develop local teaching aids. Also see: Tromsoe Mine Victim Resource Center.

High Center for Research and Informatics (HCRI)
Dr. Hameed Jahanlu
25 Farrokh Ally
Moghaddas Ardabily
Ave. Tabnak/Chamran
Tehran
Iran

Tel +98 212 112114
Fax +98 212 112502
Email jahanlu@hcri.ac.ir

HCRI coordinates mine victim assistance programs in Iran. Distributor of *War Surgery, Field Manual* (Farsi edition).

Dr. Samia Hameed Ahmed Ali
C/O Natsha Optics
Å O Box 8190
P.C. 12217 Amarat
Khartoum
Sudan

Email samia.ali@usa.net

Workgroup for mine victim assistance in Sudan.

Medico International

Main office:
Obermainlage 7
001 Frankfurt
Germany

Tel +49 69 944380
ax +49 69 436002
mail info@medico.de

Nicaragua:
el/fax +505 2 668199
mail medico@ibw.com.ni

ngola:
aixa Postal 46
uanda

el/fax +244 2 352309
mail skasack@compuserve.com

n international medical relief NGO with good rassroots programs for mine victim assistance.

ag Hammarskiold Foundation
evre Slottsgatan 2
ppsala
veden

el +46 18 105472
x +46 18 122072
mail secretariat@dhf.uu.se

center for alternative development issues in the South. elps with network building and workshops.

Vorld Health Organization (WHO)
r. Pierre Bwale, Senior Advisor Mine Victim Assistance
vision of Humanitarian and Emergency Action
ve. Appia 20
02 Geneve
vitzerland

l +41 227 913468
x +41 227 910746
nail bwalep@who.ch

ordinator for training programs in mine victim sistance.

RIDGE
rk House, Langrigg
mbria CA5 3LL
K

/fax +441 697 323705
nail

GO with extensive experience in rehabilitation of ne-infested communities.

Mines Advisory Group
45-47 Newton Street
M1 1FT Manchester
UK

Tel +441 612 364311
Fax +441 612 366344
Email maguk@mag.org.uk

The most professional of international mine action NGOs (surveys, mine awareness, and clearance programs).

Third World Network
228 Macalister Road
10400 Penang
Malaysia

Tel +60 42 266728
Fax +60 42 264505
Email twn@igc.apc.org

A main publisher/distributor of books and magazines on Third World issues.

Teaching-aids At Low Cost (TALC)
P O. Box 49
St. Albans
Herts AL1 5TX
UK

Tel + 441 727 853869
Fax +441 727 846852
Email talcuk@btinternet.com

A main publisher and distributor of low-cost medical teaching aids and books including *Save Lives, Save Limbs.*

Laerdal Medical
P. Box 377
4001 Stavanger
Norway

Tel +47 51 511700
Fax +47 51 523557
Email laerdal@laerdal.no

Produces dummies and teaching aids for practice in life-support techniques, including some low-priced versions for the South. Laerdal also produces *Mine Anne* ®, a full-size dummy with briskly bleeding limb injuries (artificial blood). On *Mine Anne* you can practice CPR, IV cannulation, and also stop bleeding by artery compression and gauze packing of large wound cavities.

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Johan Pillgram-Larsen MD

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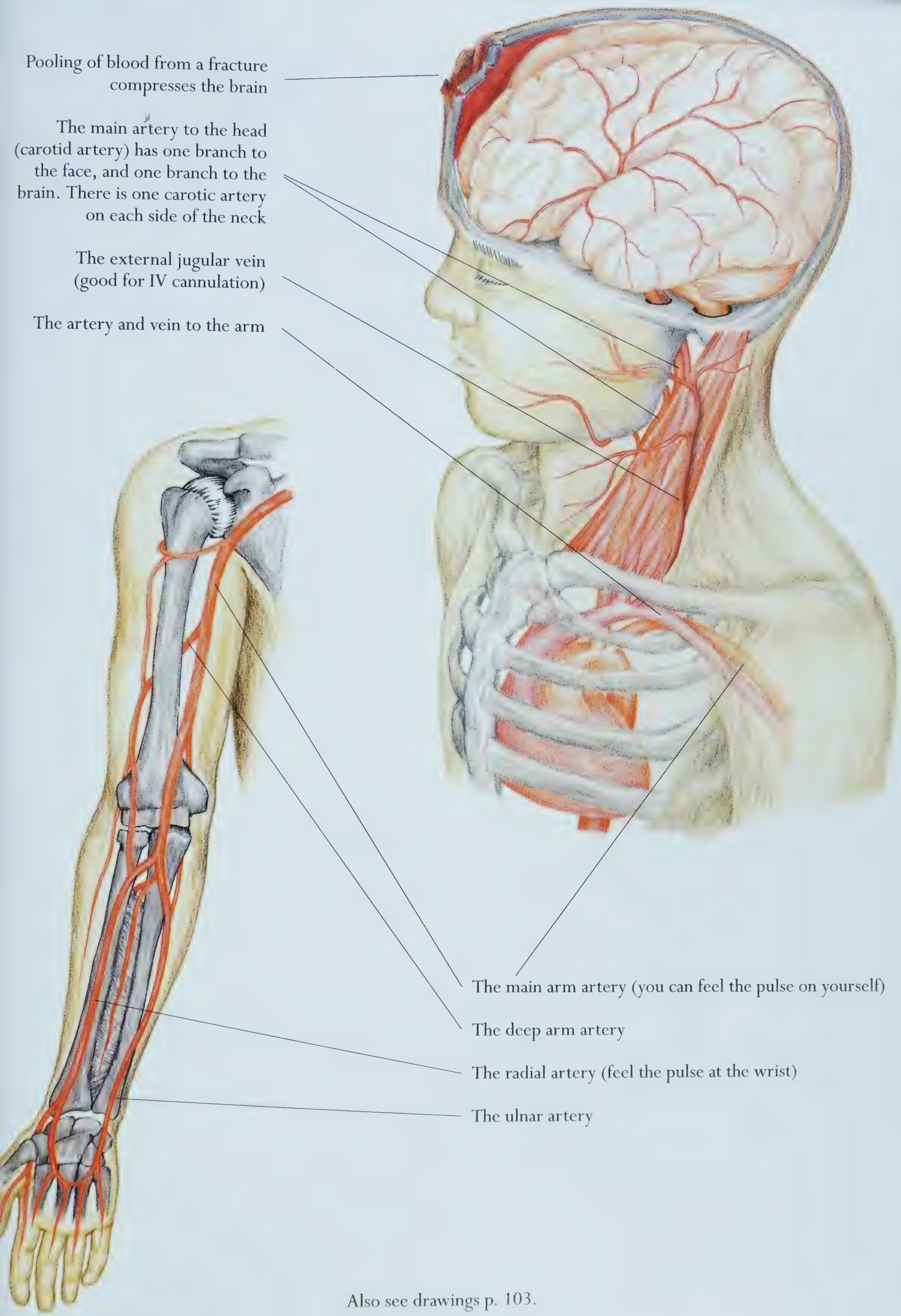
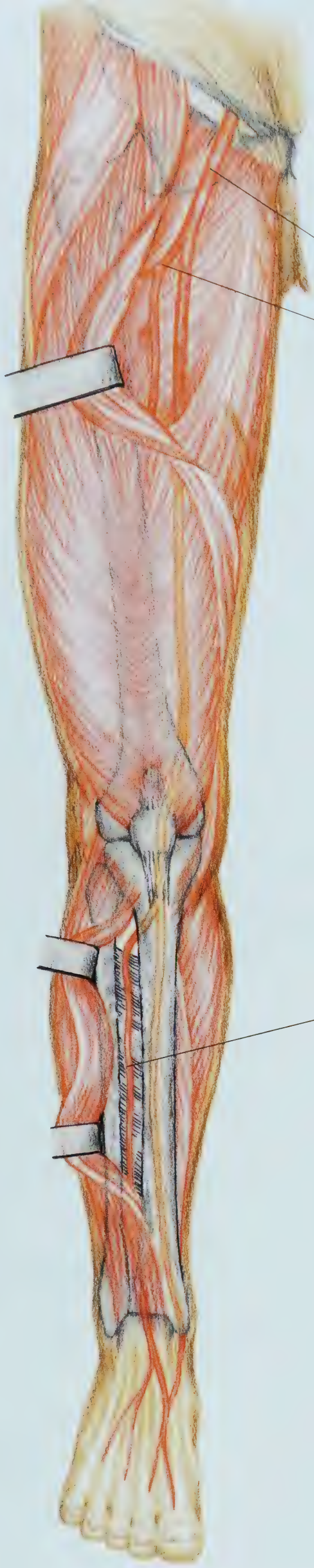
Roenn Vannsy: pp. 28, 44, 167, 201.
From Werner and Bower, *Helping Health Workers Learn:* pp. 147, 151, 166, 202.
From Moore, Mattox and Feliciano, *Trauma:* p. 201.
Laerdal Medical: p. 201.
All other drawings by Hans Husum.

Photographs
Hanna H. Hansen: pp. 20, 24, 25, 42, 52, 53, 62, 67, 76, 110, 137, 162, 163, 186.
Hans Husum: pp. 6, 21, 22, 23, 24, 26, 35, 41, 60, 63, 70, 72, 92, 104, 106, 107, 131,
134, 137, 140, 162, 163.
Mads Gilbert: pp. 6, 12, 30, 32, 53, 55, 66, 68, 69, 77, 83, 133, 147, 148, 149, 150,
151, 152, 153, 157, 159, 168, 170.
Merete Taksdal: pp. 42 and 118.
All other photographs by Trauma Care Foundation.



Also see drawings p. 103.



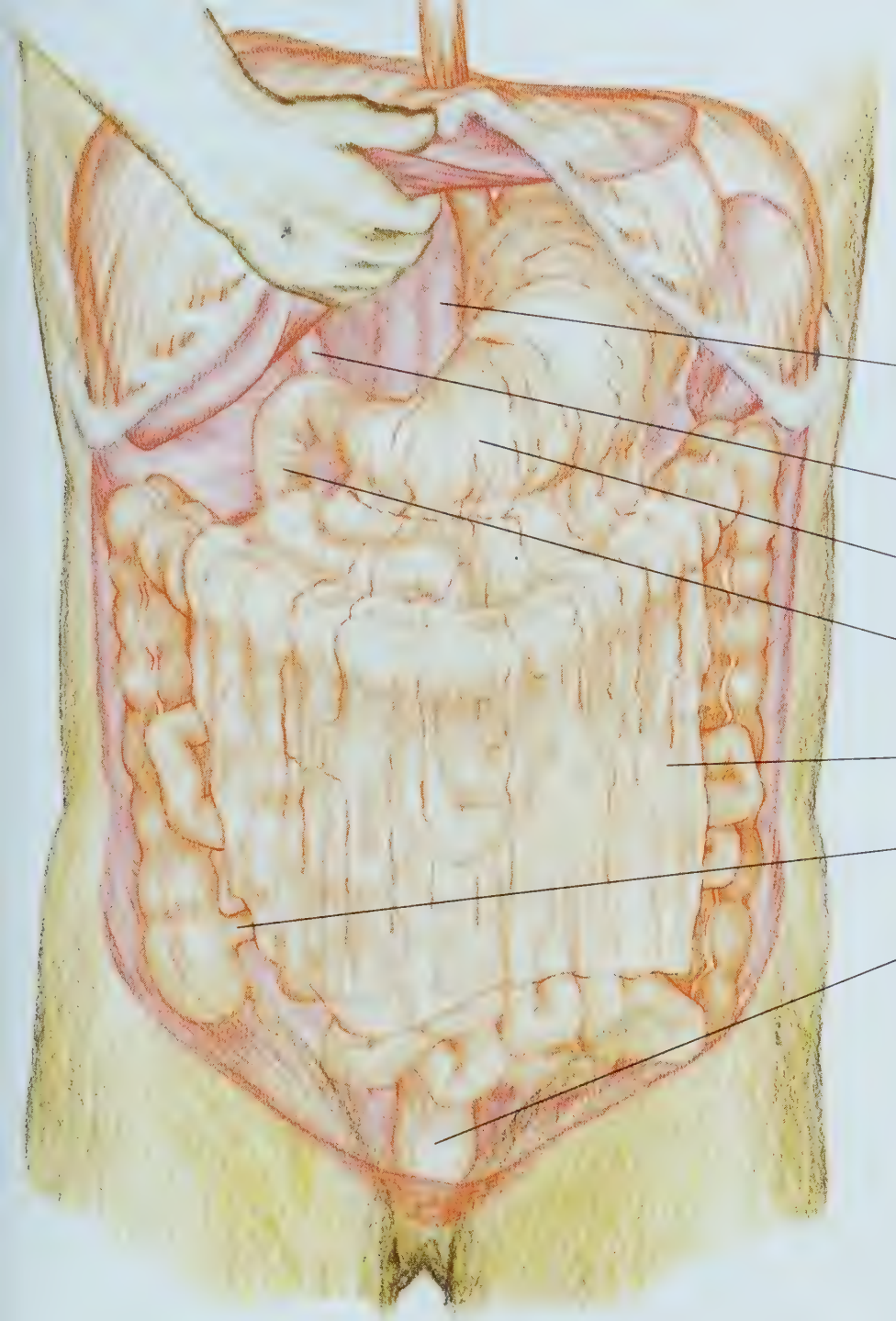
The main leg artery (feel the pulse at the groin)

The deep leg artery

Also see drawings p. 99 and 103.

The lower leg artery at the front
(feel the pulse on your foot)

There are two more arteries at the back



The aorta and the caval vein are covered by peritoneum. Press at this point to reduce bleeding during damage control laparotomy

The artery, vein and bile duct from the liver

The stomach

The duodenum, the first part of the small intestine

A thin curtain of fatty tissue protects the intestines

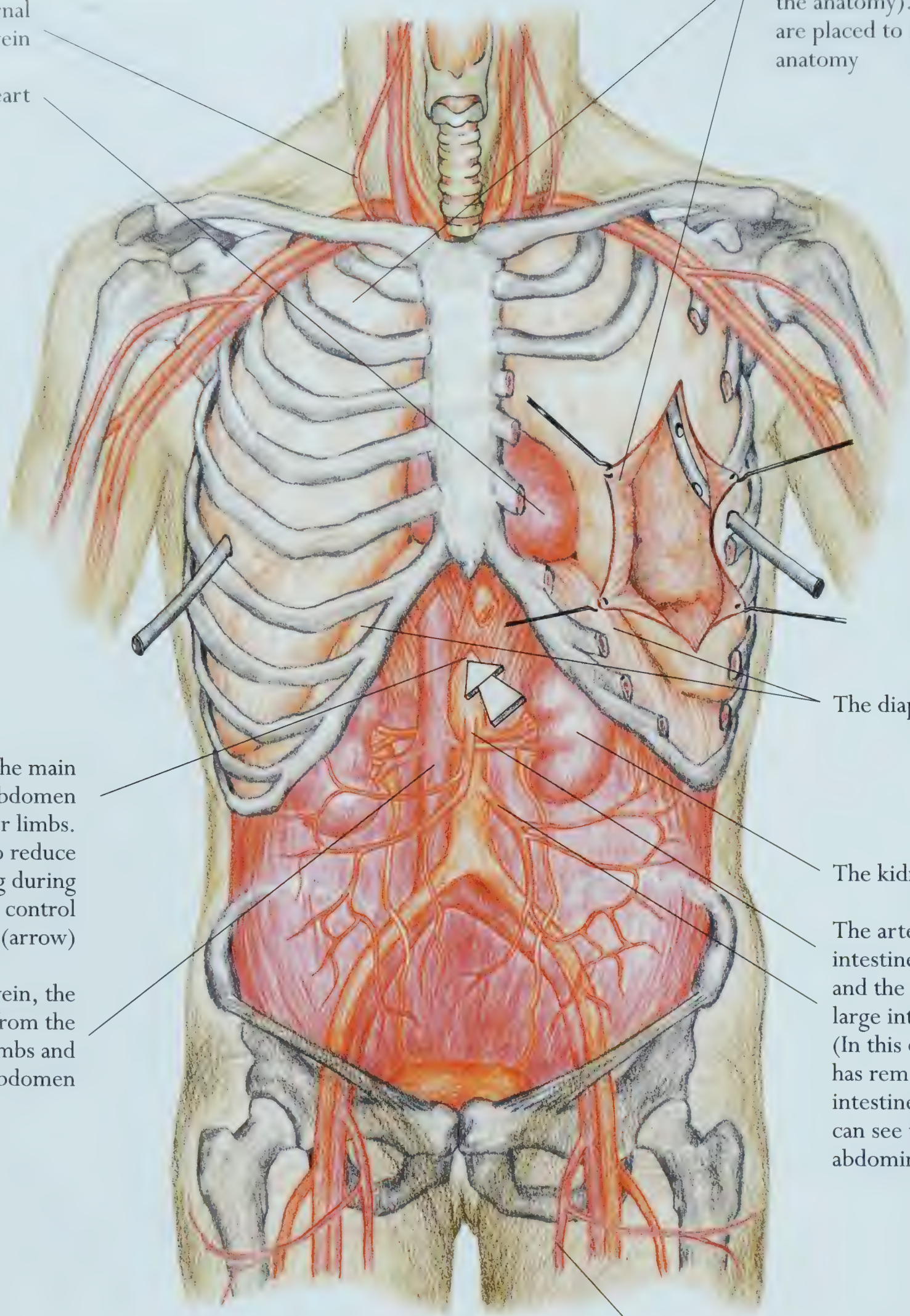
The small intestine ends, the large intestine starts

The large intestine ends in the rectum and the anus

Also see drawings p. 94-97.

The duodenum passes under the large intestine. From here the small intestine starts

Fragments shot into the abdomen will normally injury several segments of the intestine



Pleura, the sack containing the lungs. (The left lung is partly collapsed as the pleura is opened by Hans to show the anatomy). Chest tubes are placed to illustrate the anatomy

The external jugular vein

The heart

The diaphragm

The aorta, the main artery to the abdomen and lower limbs. **Press here** to reduce bleeding during damage control laparotomy (arrow)

The kidneys

The artery to the small intestine,
and the artery to the large intestine.
(In this drawing Hans has removed the intestines so that you can see the back of the abdominal cavity)

The caval vein, the main vein from the lower limbs and abdomen

The saphenous vein, the main superficial vein from the leg.
Also see p. 98 and 99.

Glossary

All words in bold are listed as separate entries in the glossary. If you cannot find some terms in the glossary, look them up in the Index (p. 221). They may be explained or illustrated in the text.

A

abdomen: the cavity in the body trunk between the **diaphragm** and the **pelvis**, lined with **peritoneum**. It is commonly called the belly, and is that part of the body below the chest and above the **pelvic** bone

abdominal: which belongs to the **abdomen**, i.e. abdominal pain, abdominal organs

abscess: a cavity or space filled with **pus**

absorb: to suck up, take into

adrenaline: a substance produced in the body which makes the heart beat stronger and faster, and the blood pressure increase. It also causes the blood vessels to narrow, and is responsible for the cold sweaty feel of people who are in shock. Adrenaline is also produced as a drug for injection

airway: the whole air-passage from the nostrils to the lung tissue. It consists of the nasal cavity, the **pharynx** (the cavity at the back of the nose), **larynx** (voice box), the **trachea**, and the smaller airways inside the lungs

albumin: a **protein** found in the blood

allergy/allergic: the body's way of over-reacting to certain substances. It can be mild like a local skin rash (skin allergy), hay fever (the upper **airways** reacting to substances in the air), or severe when the blood forms allergic complexes to drugs like **penicillin**, or a different type of blood during blood **transfusion**

amputation: removal of a part of the body by force, either planned as in surgery or accidental in injuries

analgesia: "without pain", to remove or decrease pain with the use of drugs and injections

analgesic: a drug which reduces pain, given either orally, as **injection**, or as an ointment

anatomy: the systematic description of the body's **organs** and structure, like a land map

anesthesia, general: injection or breathing in of **anesthetics** which temporarily turn off the higher brain centers so that the victim becomes **unconscious** and unaware with no sensation of pain

anesthesia, local: injections of substances which abolish all sensations, making an area "numb" and painless so that surgery can be carried out

anesthetics: substances which cause **anesthesia**

anterior: to the front, in the front part of the body as opposed to **posterior** which is the back

antibiotic: a drug which prevents **bacteria** from living and growing in the human body

antidepressants: drugs which makes the mood better when used in patients with **mental** illness

anti-tilting device: a mechanism which makes a mine explode when it is tilted

anus/anal: the opening at the bottom end of the intestinal canal, where the **rectum** meets the outside, where the back passage opens to the outside

aorta: the largest **artery** in the body, which carries blood rich in **oxygen** away from the heart. It runs from the heart to the **pelvis** in front of the **spine**, and gives out branches as it does so, finally dividing in two at the level of the **pelvis**

artery: an elastic blood vessel with thick muscular walls carrying **oxygen**-rich blood from the heart to all parts of the body

artery forceps: a surgical clamp used to close blood vessels during surgery

aspirate/aspiration: to suck out a substance from a cavity, often used for the back-flow or vomiting of stomach contents into the lungs, causing choking

axilla: the armpit

B

bacteria: one-celled invisible **organisms** which are found all over. Some are harmless, others are or may become harmful depending on the environment they are in. When bacteria multiply in places where they are not supposed to be, they may cause **infection**

blast mine: a mine which produces a **blast wave** when it explodes

blast wave: the pressure of air made by the exploding blast mine which acts like a hammer against body parts close to the explosion. The blast wave also shoots pieces of the mine case and stones from the ground around it

blood oxygen: the content of **oxygen** in the blood

blood platelets: small pieces of tissue that circulate in the bloodstream. The platelets help stop bleeding by forming blood **clots** and making small blood vessels constrict. The platelet function is dependent on a normal body temperature. When very cold the platelets do not work, and **clotting** fails

blood pressure: the pressure inside the **arteries** which makes the blood flow through the vessels. The blood pressure is measured with a cuff around the arm (see p. 186.)

blood volume: the amount of blood inside the blood vessels and the heart. The blood volume varies with age and gender, it is measured in **mL** or **L**

blunt injury: injury caused by a non-sharp object hitting the body from outside (contrary to **penetrating injury**)

bombie: a **fragmentation mine** made as a small ball usually spread in large numbers by air planes. Bombies can explode when they hit the ground, or explode later on when somebody touches them

bone marrow: The blood-forming tissue inside the cavities of the long bones. The bone marrow produces blood cells

booby trap: a hidden mine or bomb, e.g. a small **blast mine** placed at the top of an anti-tank mine in order to injure the person who tries to disarm the anti-tank mine

bounding mine: "jumping mine", a mine which has two explosive loads: one to lift it above the ground before the main explosive goes off, the other to shoot the contained **fragments** as far as possible

breath sounds: the sounds from the lungs and **airways** as heard at a distance (mainly from the upper **airways**), or with the **stethoscope** on the chest wall (mainly from the lung tissue)

buprenorphine: a **morphine**-like **analgesic** which may be given orally

C

C (Centigrade): a measure of temperature. In the Centigrade scale 0° (zero degrees) is the freezing point of water, and 100° the boiling point of water

cal: abbreviation for **calorie**, a unit to measure **energy**. One **calorie** is the amount of **energy** that raises the temperature of one gram of water by one degree Centigrade

caliber: the **diameter** of a cylinder, e.g. a **cannula** or a bullet. Don't mix up the many different units of measurement (mm, CH, and Fr, see more on p. 189)

calorie: see **cal**

cannula: a hollow needle to use for **injection** or **infusion**. May have a plastic **catheter** on its outside to be left inside a **vein**

cannulation: to insert a **cannula** into a **vein** or another cavity in the body

carbohydrate: a group of chemical substances found in most kinds of food. It contains carbon, **hydrogen** and **oxygen**. When burnt by the body **enzymes,** it produces **energy** for living activities. Sugar is a **carbohydrate**, and so is starch

carbon dioxide (CO_2): This is the gas produced when the body slowly burns **carbohydrate** in **oxygen** (air) in order to produce **energy**. The **carbohydrate** is then transformed to **carbon dioxide** and water, the **carbon dioxide** is carried with the blood to the lungs and out to the air

cardiac: which belongs to the heart

cardiac arrest: means the heart has stopped beating, the blood flow through the body has stopped. The victim is not awake, not breathing and no pulse can be felt

cardio-pulmonary resuscitation (CPR): Cardio is heart, **pulmonary** is lungs. **CPR** is **rescue breathing** and **chest compression** in an attempt to rescue a victim with **cardiac arrest**

carotid: the main **arteries** arising out of the **aorta** carrying blood to the head and neck

catheter: a hollow tube which can be inserted into cavities of the body, e.g. into the bladder to drain urine out, through the nose into the stomach to drain gas and fluid, into the blood vessels to give **infusions** and drugs

centimeter: See **cm**

ch: a measure of **diameter** of catheters and tubes. See table on p. 189

chain of survival: all support that is needed from the injury to the **rehabilitation**, including bystanders, **first helpers**, **medics**, hospitals and **prosthetic** technicians

chest: the cavity above the **diaphragm** beneath the **chest** wall. Lined by the **pleura** and containing the lungs, heart, **airways** and large blood vessels

chest compression: a technique which applies pressure on the chest wall to circulate the blood during **cardiac arrest** – where the helper compresses the chest with his hands to do the work of the heart

chest tube: a catheter to insert into the **pleura** to drain blood and/or air collecting between the lung and the chest wall

circulation: the blood circulation. Blood flow. It refers to the way blood is carried round the body. The lungs make **oxygen**-rich blood for the heart to pump round the body, and then after the body uses up the **oxygen**, the blood carries the waste product **carbon dioxide** back to the lungs. The circulatory system consists of the heart, lungs, **veins**, **arteries**, and the blood itself

clavicle: the collar bone connecting the breastbone with the shoulder blade

clotting: one of the body's mechanisms to stop bleeding by which **blood platelets** and other substances make the blood turn into a jelly-like substance

cm (centimeter): unit to measure length. One **centimeter** = 10 **millimeter (mm).** 100 **centimeter** = 1 **meter (m)**

collapse: fall together or break down, e.g. the lung during **pneumothorax**, or the **circulation** due to sudden loss of blood pressure

colloids: fluids for **IV infusion** containing large **molecules**. More colloids in the blood draw water from the tissues into the bloodstream and help increase the **blood volume**, and therefore the blood pressure

colon: the large intestine, divided into the ascending (the right part, where it starts), transverse (the middle part), descending (the left part) and **sigmoid** colon (the last part, closest to the anus)

comminuted (fracture): fracture where the bone is broken into several (more than two) pieces

compound (fracture): open **fracture** where the skin is breached. This means that **bacteria** from outside can enter the **fracture** and **infect** it

compressive: which presses. E.g. compressive dressing which is an elastic bandage around a limb to reduce the **blood flow** and help stop bleeding

conjunctiva: the reddish lining of the outer part of the eyeball and the inner side of the eyelids

contamination: the introduction of **bacteria**, e.g. into a wound

convulsions: violent and irregular motions of the limbs, e.g. as an effect of brain injury

cornea: the clear lining over the pupil of the eye

CPR: see **cardio-pulmonary resuscitation**

cricoid pressure: to press on the cartilage below the "Adam's apple" to close the **esophagus** in order to prevent **aspiration**

crico-thyroid membrane: the membrane between the "Adam's apple" and the cartilage below (the **cricoid**)

crystalloid: a solution which contains only natural salts (**electrolytes**) in water (e.g. **Ringer** and **Normal Saline**)

cyanosis: a bluish color of the skin, the **conjunctiva**, or the under-surface of the tongue. **Cyanosis** is caused by **oxygen starvation** which makes the blood become dark

D

damage control laparotomy: a brief **emergency** operation where the **abdomen** is opened (**laparotomy**) to control bleeding from damaged organs, then the **abdomen** is closed temporarily. This is a life-saving procedure, mainly to stop the injured from bleeding to death. Repair of injured **abdominal** organs is done at a later stage

debridement: removing dirt and dead body tissue. The surgical technique of cutting away damaged and dead tissue and mechanically removing dirt particles from a wound

debriefing: to disclose. To talk systematically about dramatic incidents to collect experience and relieve **mental** strain

decompress: to reduce pressure, e.g. to use a stomach tube to deflate a stomach filled with gas

deflate: to empty an air-filled space as in **pneumothorax**

dehydration: reduction of the water content of the body, as when losses of water by **diarrhea** are not replaced by drinking enough fluid

diameter: the size/**caliber** of a tube (the greatest distance across a tube from one wall to the other). **Diameters** are measured in **mm** or **cm** (see more on p. 189)

diaphragm: the **transverse** dome-shaped muscular layer which separates the **chest** from the **abdomen**. The **diaphragm** is also the main muscle for breathing

diastolic (blood pressure): the lowest blood pressure inside the **arteries** between each heartbeat (contrary to the **systolic blood pressure**). This is when the heart relaxes most after it has contracted. The maximal contraction of the heart produces the **systolic** pressure

diazepam: a drug which relieves anxiety and muscle convulsions, to be given orally or as an **injection**

discharge: to send out. E.g. to release a victim from the hospital, or the pus coming out of an infected wound

disinfectant: substance used for **disinfection**

disinfection: to kill **bacteria** and **micro-organisms** by chemicals, heat, or **radiation**

distal: away from the head (contrary to **proximal**)

documentation: to collect information in a systematic way. E.g. an exact written description of the victim's history, injuries, and treatment

dorsal: in the back or at the back part, e.g. the **dorsal** side of the hand is the side opposite to the **palm**

duodenum: the first 30 cm of the small intestine

dummy: a model looking like the original. E.g. a man-like doll used for training in medical measures

E

echo training: when one person has been trained and in turn trains more people, knowledge is spread like an echo

edema: swelling of parts of the body due to pooling of water in the tissues

electrolytes: naturally occurring salts dissolved in water. **IV** electrolytes are fluids for **IV infusion,** composed of salts dissolved in water

elevate/elevation: raising a limb above the level of the heart to reduce bleeding and facilitate the return of blood to central parts of the body

emergency: crisis, when something must be done immediately to prevent further damage

endemic: coming from the local community. **Endemic** diseases are **infectious** diseases that are common in a given area

endotracheal intubation: to pass a tube through the **pharynx**, through the **larynx**, and into the **trachea** to make sure that the **airway** is open, and to support the breathing

energy: "force" or strength to change. E.g. heat **energy** of fire, or movement **energy** of a car or a bullet. **Energy** is measured in **cal (calories)** or **kcal** (**kilocalorie** which is one thousand **calories**)

enteral: the intestine and stomach. **Enteral** drugs or **nutrition** are given by mouth or by tube into the stomach and **absorbed** into the bloodstream from the intestines

entrapment: to be caught in a trap. E.g. a swollen muscle being squeezed between the bones and the muscle **fascia**

epidemic: coming from outside the local community. Used for **infectious** diseases that spread from one community to another

epiglottis: a part of the **pharynx** behind the tongue above the inlet to the **larynx**. Used as a landmark during **endotracheal intubation**

esophagus: the gullet, or the tube through which food passes from the throat to the stomach

evacuation: the transport of victims from the site of injury to the hospital

expat: expatriate, person or organization from another country

extension: straightening of arm or leg

external: on the outside (of the body), contrary to **internal**

external bleeding: bleeding out through the skin from a wound

extractor: a suction device. E.g. a **mucus** extractor to suck blood and vomit from the **airways**

F

fascia: a strong non-elastic sheath covering muscles. Often groups of muscles are contained in separate fascia rooms

fasciotomy: to split open the muscle **fascia** so that a swollen muscle can expand

fat: naturally occurring part of most food with a high **energy** content. In the body **fat** is mainly for the storage of **energy**. The burning of one gram of fat gives 9 **calories**

fatal: leading to death

femoral: which belongs to the **femur**

femoral artery: the large **artery** of the thigh which delivers blood to the lower limb

femoral vein: the large vein of the thigh draining blood from the lower limb

femur: the thigh bone
fermentation: a natural process where starch is broken down into sugar (**malting**)
finger-clamping: to compress a blood vessel with the fingers
flexion: bending of arm or leg
fracture: broken bone
frag mine: see **fragmentation mine**
fragmentation: splitting up into small components
fragmentation mine: a mine made to shoot a lot of small pieces of steel when it explodes
fragment wound: wound caused by **fragments**, it can be fragments from a mine, bullet, or grenade
Fr (French): a measure of **diameters** of **catheters** and tubes. See table on p. 189
funding: raising or collecting money for a purpose or project

G

G (size of needles and cannulas): the larger the **G**-value, the thinner the needle. See table on p. 189
/gram (weight): unit to measure weight. 1,000 **gram** is the weight of one liter of water
astric: which belongs to the stomach
lucose: sugar, the smallest part of **carbohydrates**. **Glucose** is the basic fuel used in the body to produce **energy**. One gram of **glucose** gives 4 **calories** when burnt
lycogen: starch, made of several units of **glucose** linked together. The **glycogen** in liver and muscles is the main store of **carbohydrate** in the body
ram (classification of **bacteria**): the **Gram** staining technique is used in laboratories to classify **bacteria** in two main groups, **Gram**-positive and **Gram**-negative bacteria. Using **Gram** stain, the **Gram**-positive **bacteria** stain deep purple, and the negative ones appear very light pink

H

eart rate (HR): the number of times the heart beats within one minute
ematoma: pooling of blood outside the blood vessels. This can only happen when blood vessels are damaged
emo-: which belongs to blood
emolysis/hemolytic: rupture of the red blood cells
emo-pneumothorax: gathering of blood (**hemo**) and air (**pneumo**) in the **pleural space** inside the **chest**
emothorax: blood pooling in the **pleural** space inside the chest
epatic: which belongs to the liver (hepar)
gh-energy food: food with a high content of **calories**
ormones: chemical substances which regulate the function of all organs of the body. **Hormones** are produced by the body, some are available as drugs
R: see **heart rate**
per-: increased
hypersensitivity: when the body reacts with increased intensity to drugs or naturally occurring substances. E.g. **allergy** to **penicillin**
hypertension: high blood pressure. Upper limit for the normal **systolic** blood pressure in the adult is usually defined as age + 100 mm Hg
hypo-: reduced
hypotension: low blood pressure (**systolic** blood pressure less than 100 mm Hg). Seen when the **blood volume** is less after bleeding or diarrhea, heart failure, or **allergy**
hypovolemia: less than normal volume of blood circulating in the body
hypoxia: oxygen starvation, less than normal content of **oxygen** in the body

I

IM: inside muscles. See: **intramuscular**. See: **injection**
immune system: the defenses of the body against **infection**
incision: a cut, surgical opening of the skin with knife or scissors
infection/infectious: destruction of tissues due to rapid growth of **bacteria** in a part of the body where they don't belong. Local signs of **infection** are swelling and redness, general signs are fever and pain
inflammation: swelling and red discoloration, a reaction to **infection**, injury, or **allergy**
infusion (IV infusion): continuous introduction of fluid under low pressure into the bloodstream through a **cannula** or **catheter** in a **vein**
infusion set: the plastic tubing used to pass fluid from an infusion bag into the venous cannula
injection: to force a small amount of fluid into the body by the use of a syringe and a **cannula. Injections** can be done under the skin **(subcutaneous, SC),** into the muscles **(intramuscular, IM),** or into the veins **(intravenous, IV)**
inter-: between
internal: inside (the body)
internal bleeding: bleeding which is inside the body and not necessarily seen from the outside, as into the **abdomen** or **chest**
intestine: the whole gut from the stomach to the **rectum**. Made up of the **duodenum**, the **small intestine,** the **colon** and the **rectum**
intra-: inside
intramuscular: inside muscles. Also see: **injection**
intravenous: inside a vein, i.e. directly into the blood
intubation: to introduce a tube. See **endotracheal intubation**
IV. See **intravenous.** Also see: **injection, infusion**
IV electrolytes: see **electrolytes**
IV infusion: see **infusion**
IV volume treatment: to replace lost blood or body fluid by **intravenous infusions** of fluids

K

kcal: kilocalorie. One kcal = 1,000 **calories**. See: **cal**
ketamine: a drug which is injected to produce **analgesia** and **anesthesia**, may be given **intravenous** or **intramuscular**
kg: kilogram (**kilo**). One **kg** = 1,000 **gram (g)**
kilo: thousand
kwashiorkor: starvation where there is lack of **protein**

L

laparotomy: a surgical opening of the **abdomen**. Also see **damage control laparotomy**
laryngoscope: an instrument with a handle, a blade and a light bulb used for **laryngoscopy**
laryngoscopy: looking through the mouth and the **pharynx** into the **larynx,** with the help of the **laryngoscope** to perform **endotracheal intubation**
larynx: the upper end of the **trachea** below the throat, containing the **vocal cords**. You can feel the **larynx** from outside at the neck as the "Adam's apple"
lateral: to the outer side of, away from the mid line of the body, as opposed to **medial**
Ligature: a **suture** tied around a blood vessel to stop bleeding
lower leg: the leg between the knee and the ankle
lower limb: the leg all the way from the groin to the toes

M

m (meter): Unit to measure length. One **meter** = 100 **cm**
malnourished: a person who has been eating too little or the wrong kind of food for some time
malting: a technique to split **starch** into sugar. Also see: **fermentation**
manual: by hand
marasmus: starvation where there is lack of both **protein** and **energy** (**calories**)
mass casualties: accidents with several victims
medial: towards the mid line of the body, contrary to **lateral**
medic: see **paramedic**
mega: million. 8 mega IU penicillin = 8 million international units of penicillin
mental: which belongs to the mind
mesentery: a fold of **peritoneum** which suspends the small intestine to the walls of the **abdomen**. **Arteries**, **veins** and nerves to the small intestine pass through the **mesentery**
metabolism: chemical processes in the body which produce **energy** to sustain life
meter (m): unit to measure length. One **meter** = 100 **cm**
micro-organism: a very small living thing, e.g. **bacterium** or **virus**. **Micro-organisms** can only be seen with a **microscope**
microscope: a type of very strong binoculars used t study **micro-organisms**
mid-axillary line: a line extending from the middle of th armpit (**axilla**) to the hip
millimeter: See **mm**
mine infested: an area where mines are commonly foun
mm (millimeter): unit to measure length. 10 **milli meter** = 1 **centimeter** (**cm**)
molecule: the basic building block that makes up all thing and organisms. **Molecules** are very small, only th largest of them can be seen with a **microscope**
morbidity: rate of diseases (or complications to injur and surgery)
morphine: a narcotic opium-like drug used for **analgesi**
mortality: death rate
mouth-to-mouth breathing (rescue breathing) artificial breathing where the helper blows air into th mouth of the victim. Also see: **CPR**
MUAC: mid-upper arm circumference, a measure of under nourishment
mucus: thick, slimy body fluid found in the upper **airwa**
multi-organ failure: failure of important organs as a effect of severe injury and/or major surgery
muscle fascia: see **fascia**

N

necrosis, necrotic: dead tissue
nervous system: the brain, the **spinal cord,** and th nerves
NGO: non-governmental organization, an organizatio which is not formally controlled by a government

O

opioid: a drug acting like opium. See **analgesic**
oral: which belongs to the mouth
organ: defined part of the body, e.g. stomach, liver, hear etc.
organism: a thing that is or has been alive
oxygen: O_2, a gas without color and smell which is part of normal air. **Oxygen** is necessary for all types o combustion in all living organisms
oxygen starvation: lack of **oxygen** in the body or in part of the body

P

paralysis: loss of ability to move a limb or part of a limb du to damage to the **nervous system**
paramedic (medic): a health worker who works alongsid nurses and doctors. E.g. health workers giving life-savin first aid outside hospitals
parasite: small worms, **bacteria** or insects which liv in/on another creature and get their food from it

paresis: incomplete **paralysis**
pelvic: which belongs to the **pelvis**
pelvic cavity: the lower part of the abdominal cavity which contains loops of the small intestine, the **rectum**, the urinary bladder, the female/male organs, and blood vessels and nerves to the legs, and is protected by the **pelvic** bonering (**pelvis**)
pelvis: the large bone ring where the lower limbs meet the **spine** and the trunk
penetrating (injury): injury caused by a sharp object cutting through the skin into the body (contrary to **blunt injury**)
pentazocine: an **analgesic**, a synthetic narcotic **opioid**
percussion: tapping/drumming with the fingers (like drum-sticks) to examine air-filled organs in body cavities, such as the **chest** and the **abdomen**. If the cavity is filled mainly with air, the drum-sound is clear. If it is filled up with fluid, the drum-sound is dull
perforation: a hole or wound into a body organ or skin
perfusion: the flow of blood through a part of the body
peritoneum: the thin lining inside the walls of the abdominal cavity. The peritoneum also covers most of the abdominal organs
peritonitis: infection of the **peritoneum**, that is, **infection** of the whole or parts of the **abdominal cavity** and the **abdominal** organs
pharmaceutical: relating to the use of drugs
pharynx: the throat
physiological severity: the effect of injury on the functions of the body, e.g. **breathing rate**, **blood pressure**
physiology: the study of body functions
pilot project: a small-scale project to collect experience before starting large-scale projects
plasma (blood plasma): the fluid part of the blood apart from the blood cells. The plasma contains water, **proteins**, and salts
platelets: see **blood platelets**
pleura: the lining on the inside of the **chest** wall and of the surface of the lung. Between the **pleura** of the chest wall and the **pleura** of the lung is the **pleural space**. It is normally just two sliding surfaces, but can be filled up with blood or air giving **hemothorax** or **pneumothorax**
pleural space: the surface between the lung and the chest wall, where blood and air may collect after injury. Also see: **hemothorax** and **pneumothorax**
pneumo-: which belongs to the lung
pneumonia: infection of the lung
pneumothorax: collecting of air in the **pleural space** due to leaking from the chest wall or the lung
post-: after, behind
posterior: on the back part (contrary to **anterior**)
pre-: prior to, in front of
protein: large **molecules** made up of **amino acids** the building blocks of muscle, a component of food
proximal: towards the head (contrary to **distal**)
psychology: the study of **mental** reactions and emotions
pulse: the peaks of **blood pressure** in the **arteries** coming with each heartbeat
pus: collection of dead tissue, blood cells and **bacteria** in a thick fluid caused by local **infection**

Q

quadrant: a quarter of a given area. E.g. we divide the **abdominal cavity** in four quadrants to locate injuries
quality: how good or bad a thing is
quantity: the number of things

R

range: the distance between two things/points. E.g. the distance from the gun to the victim who is shot, or the difference in years between the youngest patient and the oldest in a group of patients
rate: how often a thing happens within a period of time. E.g. the number of heartbeats every minute is the **heart rate** per minute
rectal pouch: the space inside the **abdominal cavity** in front of the **rectum** where blood or pus may collect
rectum: the last part of the large intestine ending at the **anus,** also see **colon**
reflex: an involuntary reaction of the body when something happens, e.g. coughing when water or food enters the **larynx**
rehabilitation: healing of wounds and regaining the ability to work and live in a community
repatriation: to bring a person back to his country of origin
re-perfusion: to re-establish blood flow to a part of the body which for a period of time has been without it – as in opening a tourniquet. Also see: **perfusion**
rescue breathing: artificial breathing where a helper with different techniques gets air in and out of a victim who is unable to breathe
respiration: breathing
respiratory rate (RR): the number of breaths within one minute
resuscitation: all efforts used to revive normal body functions, most often used are **chest compression**, **rescue breathing**, and **IV volume treatment**
retro-: behind/under. E.g. **retroperitoneal** bleeding: bleeding behind/under the **peritoneum**
RR: see **respiratory rate**

S

saliva: secretion in the mouth which makes the mouth water
salivation: the excessive production of **saliva** in the mouth
saphenous vein: a large **vein** located at the **medial** side in front of the ankle
SC: see **subcutaneous**
scalpel: a surgical knife

self-inflating bag: A balloon used for **rescue breathing,** it expands and fills with air by itself
sepsis/septic: infection/infected
septicemia: a severe general **infection** with **bacteria** multiplying in the bloodstream
serum: see **plasma**
shock (circulatory shock): **oxygen starvation** in the tissues of the body due to failure of **blood flow,** such as following excessive blood loss, or heart failure. The signs of circulatory **shock** are cold skin, low **blood pressure** and increased **heart rate**
shock (psychological): the reaction of the mind to dramatic experience
SIB: self-inflating bag used to support the breathing
small intestine: the part of the gut from the stomach to the **colon**
spine: the backbone from the base of the skull to the **pelvis**
spleen: a blood-rich organ to the left in the upper part of the **abdominal cavity** behind the stomach
sterile: without **bacteria**
stethoscope: a device used to listen to the breath sounds, heart sounds and bowel sounds
stomach: the large sack-like organ in the upper part of the **abdomen** where digestion of food starts. It is connected to the **esophagus** and the **small intestine**
stomach tube: a tube used to empty the stomach for fluid and gas. It is inserted through the nose or the mouth through the **esophagus** down to the **stomach**
stylet: a metal tube that helps the insertion of soft plastic tubes. E.g. the **stylet** of an **IV catheter**, or the **stylet** placed inside an **endotracheal tube**
subcutaneous (SC): immediately under the skin. Also see **injection**
superficial: in the outer layers (of the body). E.g. a **superficial** wound reaches down to, but does not pierce through, the muscle **fascia**
supine: to be lying down on the back
suture: the thread used to stitch a wound
systolic (blood pressure): the peak **blood pressure** in the **arteries** that comes with each heartbeat (contrary to the **diastolic** blood pressure)

T

TAC: see **temporary abdominal closure**
tachycardia: increased heart rate. Usually defined as **heart rate** above 100 beats per minute in an adult
temporary abdominal closure: the use of **towel clamps** or plastic bands to perform a temporary closure of the **abdomen** after a **damage control laparotomy**
throat: the common room behind the tongue, below the nose and above the **larynx** and the **esophagus.** It is shared by air going to the lungs and water/food going to the **esophagus**
tourniquet: a bandage, rope, belt or tie wound very tight around a limb in an attempt to stop the bleeding
towel clamp: surgical instrument used to fix surgic drapes around the surgical cut during an operation. Als used for **temporary abdominal closure**
trachea: the large wind-pipe from the **larynx** leadin into the **chest** where it branches into the two lungs
transfusion (blood transfusion): IV infusion of blooc e.g. to replace blood lost
transverse colon: the middle part of the large intestin crossing the abdominal cavity from right to left
trauma: injury
tube: a hollow pipe made of rubber or plastic in differer thickness with rounded ends intended to be placed in a opening or cavity of the body, e.g. **endotracheal intu bation**

U

unconscious: not awake. May be graded according t how difficult it is to arouse the victim (response to sound to pain, no response)
undernourishment: starvation
upper limb: the entire arm from the shoulder to the tip c the fingers

V

vein: a thin-walled blood vessel carrying **oxygen**-poo blood from the distant part of the body to the heart unde low pressure
verbal: made by spoken words
village first helper: a villager who has been trained in basi techniques for assisting a victim's **airway**, breathing an **circulation**, and to assist the **medic**
village university: the training sessions for medics that ar held in the villages
vocal cords: two elastic and moveable bands in the **larynx** where the voice is formed

Index

Field injury chart

The patient

Name of medic/nurse/doctor: Name of clinic:

Name of patient:

From which village: Sex: ☐ M ☐ F

Name of patient's father: Age:

The weapon

Where did it happen: When did the injury happen:

Which type of mine (or other weapon):

How far was the patient from the explosion (meter):

Name other persons injured in the same accident:

First help

Did first helpers treat the patient: ☐ YES ☐ NO How many first helpers: When did first help start:

What kind of first help: ☐ Open airway ☐ Stop bleeding ☐ Keep warm ☐ Position

Other first help:

How was the patient transported from the site of accident: ☐ On foot ☐ Hammock ☐ Donkey ☐ Bicycle ☐ Taxi ☐ Ambulance ☐ Other:

Describe the injury

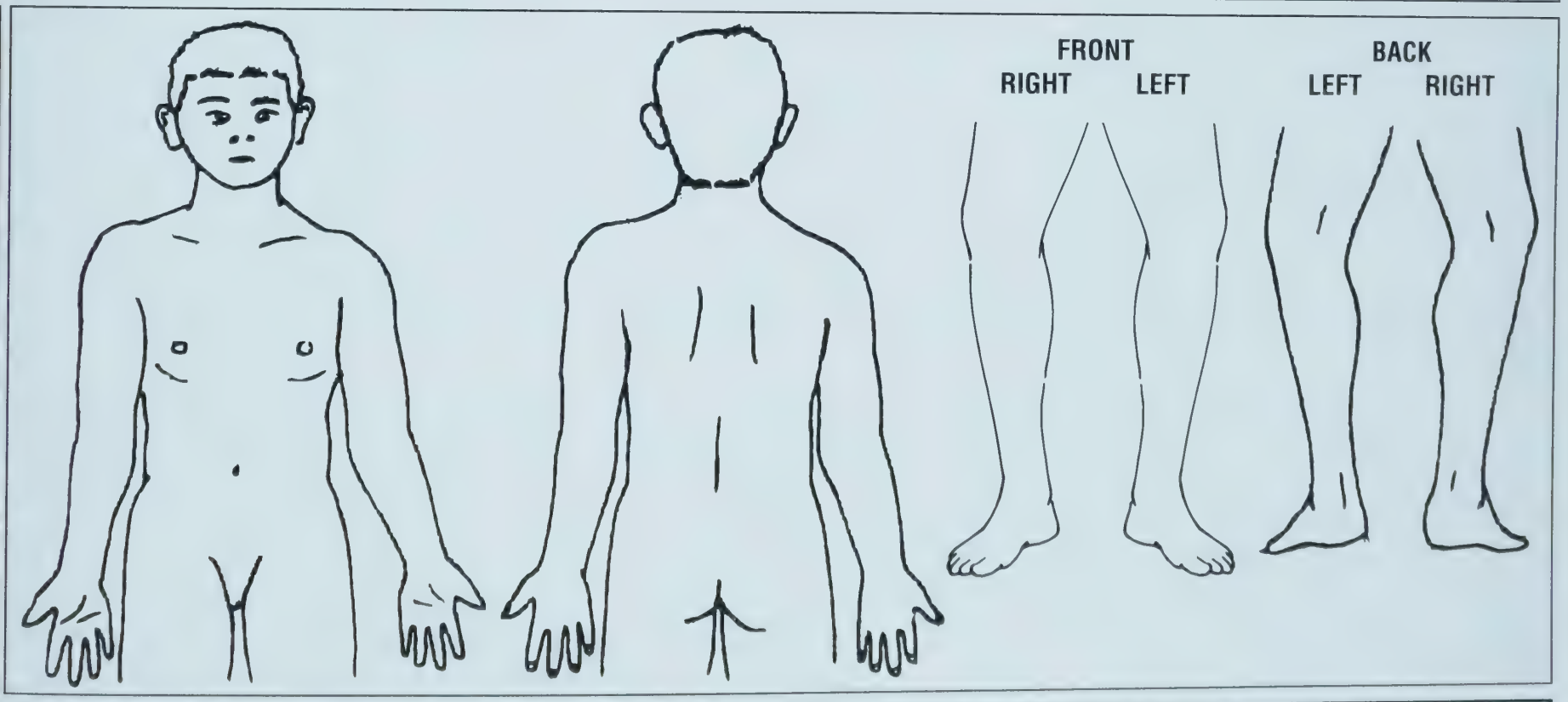
Did the patient come with tourniquet on: ☐ YES ☐ NO When was tourniquet placed:

Type of tourniquet: ☐ Rope ☐ String ☐ Clothes ☐ Tree branch ☐ Other:

Describe the main injury:

Describe the other injuries:

Draw all injuries



Before treatment

	4 points	3 points	2 points	1 points	0 points	Sum	When was this examination done:
Breaths per minute	10–24	25–35	more than 35	less than 10	no breathing		
Systolic blood pressure	more than 90	70–90	50–69	less than 50	no pulse		
Mental response	normal	confused	to sound	only to pain	no response		

Rectal temperature before treatment: °C time:

AK Grafisk

→ Hours/Days after the injury

Airway	Head tilt, chin lift											
	Cleaning of airways											
	Suction of airways											
	Position of patient (draw)											
	Intubation of airways											
	Other											
Breathing	Mouth-to-mouth											
	Bag/mask-to-mouth											
	Stomach tube											
	Chest tube											
Circulation	To stop bleeding (describe)											
	Blankets, other cover											
	Warming from outside											
	Warm IV fluids											
	Other warming (describe)											
	IV lines – how many											
	IV lines – where											
	IV electrolyte (ml)											
	IV colloid (ml)											
	Fasciotomies											
	Other surgery											
Drugs	mg ketamine IV											
	mg pentazocine IV											
	other pain relief											
	Antibiotics											
	Other drugs											
Transport	Type of transport											
	Who follows the patient											
	Problems during transport											
	Time of hospital arrival											
	Dead before hospital – when?											

At hospital admission

	4 points	3 points	2 points	1 points	0 points	Sum	When was this examination done:
Breaths per minute	10–24	25–35	more than 35	less than 10	no breathing		
Systolic blood pressure	more than 90	70–90	50–69	less than 50	no pulse		
Mental response	normal	confused	to sound	only to pain	no response		

Rectal temperature before treatment: ˚C time:

AK Grafisk

Hospital injury chart

The patient

Name of doctor:	Name of hospital:
Name of patient:	Sex: ☐ M ☐ F
From which village:	Age:
Name of patient's father:	

Time of stay

Time and date of admission:	Discharged (date):
Out-patient from (date):	To (date):
Referred to other hospital, when:	Which hospital:

Condition at admission

	4 points	3 points	2 points	1 points	0 points	Sum	When was this examination done:
Breaths per minute	10–24	25–35	more than 35	less than 10	no breathing		
Systolic blood pressure	more than 90	70–90	50–69	less than 50	no pulse		
Mental response	normal	confused	to sound	only to pain	no response		

Rectal temperature before treatment: ˚C time:

Laboratory at admission:

Hospital diagnosis

1
2
3
4
5

Treatment (type and time)

1
2
3
4
5

Hospital complications

How many units of blood transfusion:

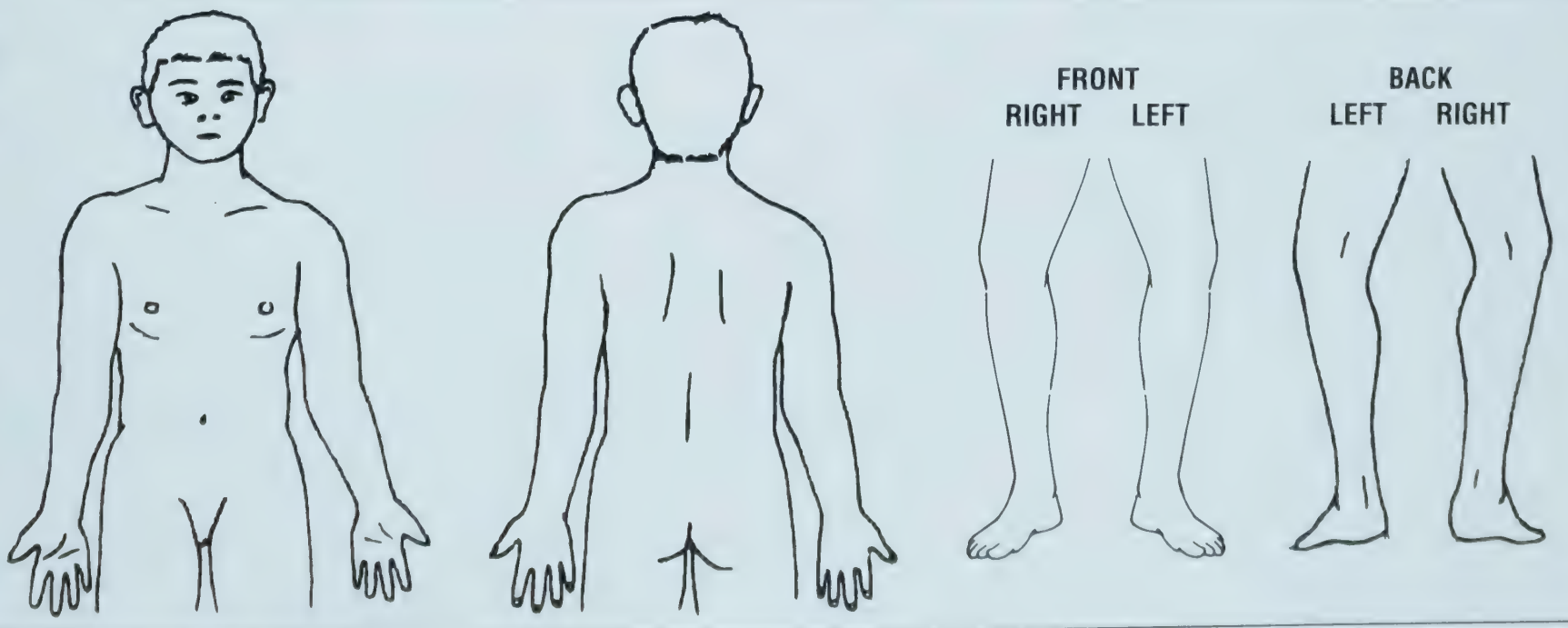
Wound infection:

Peritonitis:

Pneumonia:

Other:

Draw level of surgical amputation



Mortality

Time of death:

Main reason for death:

Remarks:

AK Grafisk

Anesthesia chart

	TIME	0:05	0:10	0:15	0:20	0:25	0:30	0:35	0:40	0:45	0:50	0:55	1:00	1:05	1:10	1:15	1:20	1:25	1:30
A and B	Position of patient																		
	Intubation																		
	Breathing rate/minute (RR)																		
	Spontaneous breathing (S)																		
	Assisted breathing (A)																		
C and drugs	mL Ringer/normal saline IV																		
	mL normal saline IV																		
	mg ketamine IV																		
	mg pentazocine IV																		
	mg diazepam IV																		
	mg atropine IV																		
Observations	Temperature ° C																		
	Blood pressure ● 200																		
	Heart rate ✕ 190																		
	180																		
	170																		
	160																		
	150																		
	140																		
	130																		
	120																		
	110																		
	100																		
	90																		
	80																		
	70																		
	60																		
	50																		
	40																		
	30																		
	20																		

Name of patient: Date: Name of Medic:

t

hing?

ntubation.

-25.

umothorax?

PR.

"Had I had this book in my work as a health worker and trainer of health workers in the mountains of Mexico, many persons who died from stabbings, bullet wounds and traumatic accidents in remote villages might still be alive today. A splendid and important book."

David Werner
Author of *Where There is No Doctor, Helping Health Workers Learn,* and *Nothing About Us Without Us*

"Talk of the empowerment of impoverished and repressed communities is all too often empty rhetoric. This book is a concrete example of what can be done, practically and pragmatically, to help save lives and limbs. In the didactic traditions of *Where there is no doctor* and community solidarity work, this book is an excellent addition in helping to fill an important gap." *

Chris Paul Giannou MD
Head of Unit of Surgery and Hospital Assistance, ICRC Geneva.
Member of The Executive Committee of
Palestinian Red Crescent Society 1987-1989

"This book is the outcome of a long and intensive experience in minefields and war zones in the South where there are no helicopters, no ambulances and where hospitals are far away. By answering the question of whom to train, where and how to save lives and limbs, this manual is an invaluable resource for all workers in the field."

Claude Romer MD and Pierre Bwale MD
PVI, WHO Geneva

"Everyone who faces injury is frightened – the victim, their family or friends, and even the medic. This book has been written by people like you. They have seen what you see. They know that to meet and overcome the fear needs knowledge, understanding and practice. Only in this way can you begin the journey to save your victims' limbs and lives. The first step on this path is to open the book – so do it now."

Colin Robertson MD PhD
Consultant in Accident and Emergency Medicine
Royal Infirmary of Edinburgh

*The views expressed are those of CPG and do not necessarily represent those of the ICRC.

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